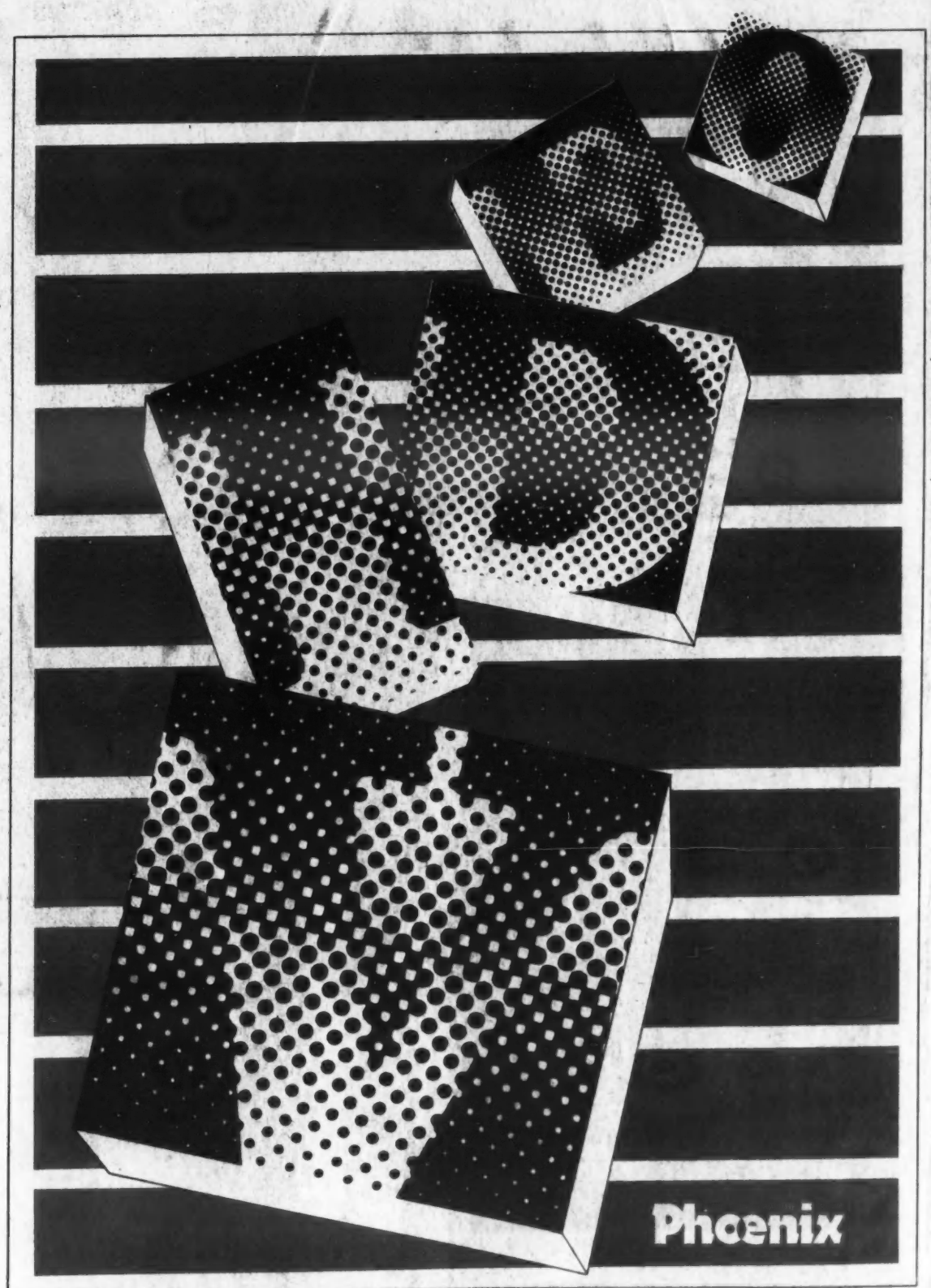

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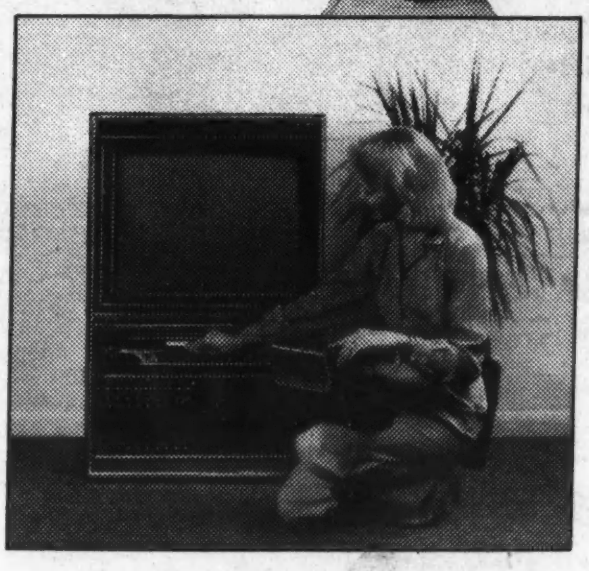

See your local RCA dealer for details

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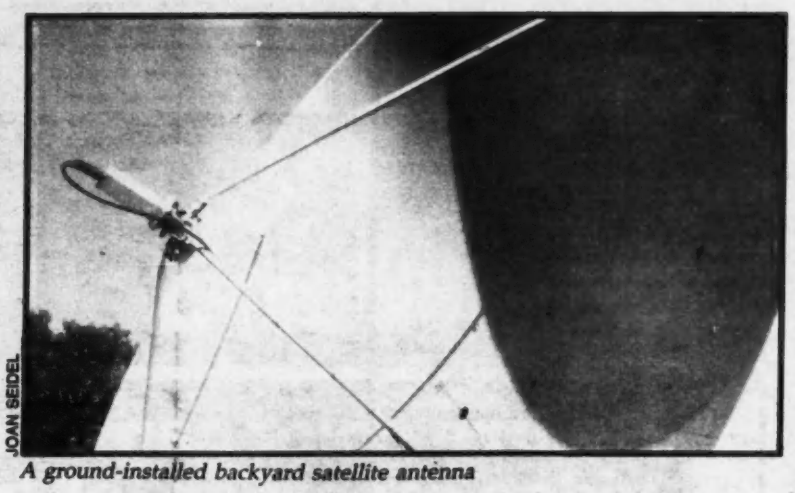
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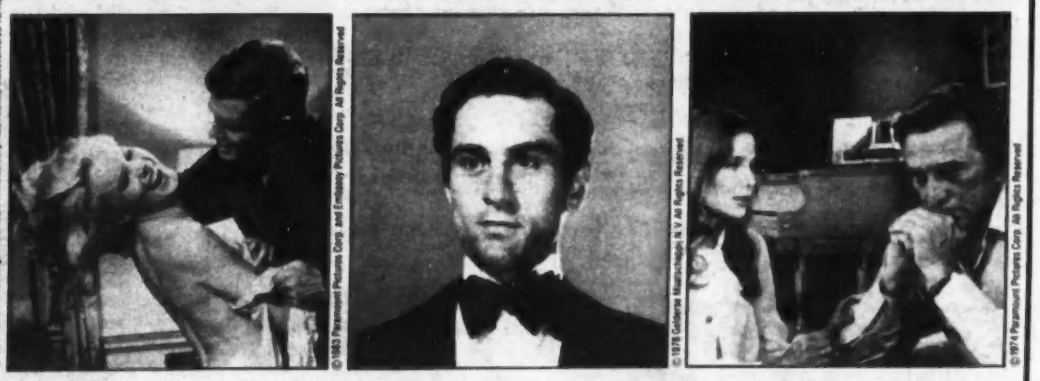

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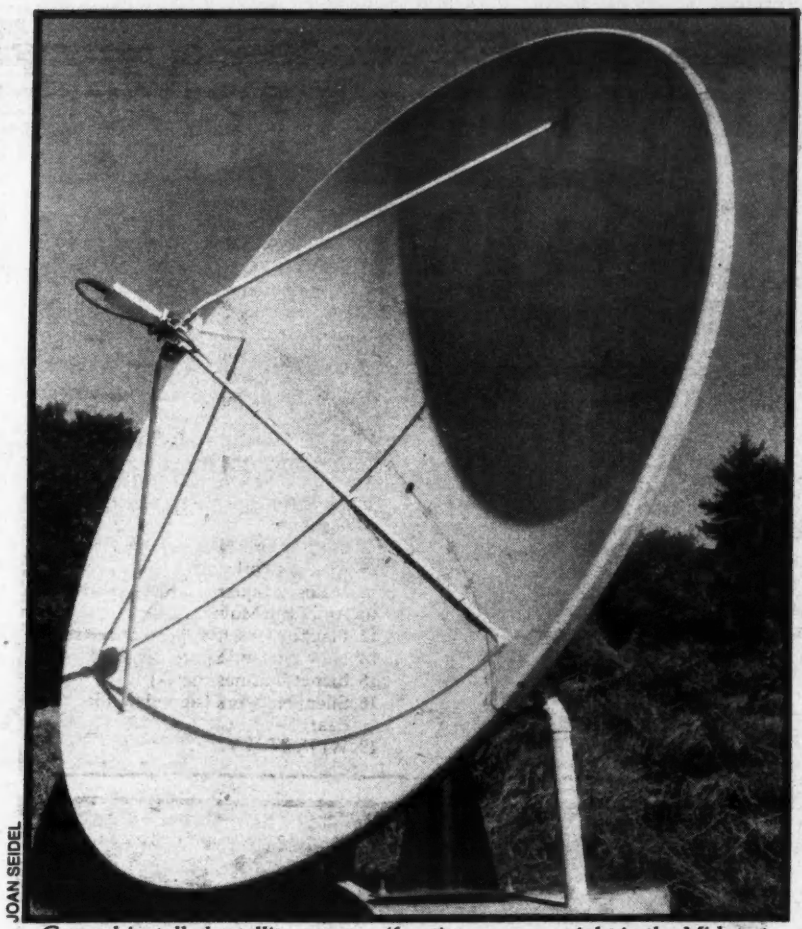


JOAN SEIDEL

Ground-installed satellite antenna (front): a common sight in the Midwest

The main dish

Serving up satellite TV

by Peter W. Mitchell

Watching television programs sent from a transmitter stationed in outer space a tenth of the way to the moon is no longer a science-fiction fantasy. It is a present-day reality on Kansas wheat farms, in West Virginia mining valleys, and in a few Boston apartments. A million US households now get their TV from satellites, and a million more dish antennas could sprout like giant mushrooms from rooftops and backyards during the next 12 months. Established antenna companies such as Wineguard and Channel Master are getting into the act, and a satellite dish is featured on the cover of the new Radio Shack catalogue — a sure sign that it is no longer an esoteric item.

Thanks to technical improvements, market competition, and efficient mass production, the cost of satellite TV has dropped by half over the past three years. A professionally installed system can be had for under $4000, and do-it-yourself hobbyists can put together a working system for half that amount. If this still seems an intimidatingly large investment, compare it with the cost of cable TV. The average subscriber pays around $35 per month for cable, or more than $400 per year, so a home assembled TVRO satellite system could pay for itself in five years. (TVRO stands for "television, receive-only," the industry jargon used to distinguish the home satellite antenna from the dish antenna used for microwave communication and for the "uplinks" that send TV signals to the satellites.)

A satellite receiving system consists of three major elements: the dish, which receives the signal energy from the satellite; the LNA (low noise amplifier), which strengthens the signal so that it can be fed through a cable into the house; and the receiver, which tunes the selected satellite channel and converts the signal into a form your TV set can handle. (See box, "The sum of its parts," below.) Many systems add a fourth element, a remote-controlled motor-driven mount that reaims the dish from bird to bird.

Indirectly you're already watching satellite TV. That's how virtually all network and cable-TV programs get to us from their points of origin. Local stations simply receive network signals from the satellite and retransmit them for local consumption. A cable-TV system is little more than a set of satellite dishes and miles of wire that distribute the signal. So when you invest in your own satellite receiving system, you're not embarking on a futuristic adventure. You're merely electing to bypass the middlemen to get your TV signals directly from the same source that TV stations and cable systems use.

Why do it? Well, the main reason is to circumvent the limitations and compromises that these middlemen impose, deliberately or not, on your television viewing. These limitations fall into three categories: picture quality, sound quality, and freedom of choice.

Picture quality. Perfect reception of every local station, with neither ghosts nor snow, is a rarity even in geographically ideal suburban locations. Excellent TV reception is even more rare in the city, where buildings and other obstacles cause flocks of ghosts, and in fringe areas, where signals become weak and snowy. Cable ought to solve these problems, but often it does not.

When I first signed up for cable, the delivered picture was so marred by ghosts that I refused to accept the installation. Fortunately, the cable installer was sympathetic: by mounting a new tap-off unit on the telephone pole in front of my house and connecting it to a different cable, he obtained near-perfect pictures on about 30 channels. Other cable companies are less responsive to customer dissatisfaction. Friends in one nearby town get interference-free pictures on only half their cable channels, whereas in another suburb the cable picture is perpetually grainy because of electronic noise in the distribution amplifiers.

With a professionally installed satellite dish, what you notice first is the consistent excellence of the picture: clear and ghost-free on most channels and rarely snowy or grainy — unless you have skimped on the dish's size or been careless about its aim. Many videophiles are finding that their high-performance video monitors and projection TV systems reveal all too clearly the ghosts and grain of their antenna and cable signals, in the same way that a new stereo system reveals the scratchy distortion of your old records. The brilliant and flawless clarity of a satellite picture is a joy to behold.

Sound quality. Wide-range stereo sound is just beginning in network TV, but it has been a featured part of satellite TV for years. There are rock videos on MTV, Dolby Stero sound tracks on Disney and the Movie Channel, classical and jazz concerts on the Arts/Entertainment, Bravo, and Black Entertainment channels, country music from Nashville, and excellent FM stereo programming.

Since most cable-TV systems can't distribute stereo-TV sound, their usual compromise is to offer a few of those stereo services to subscribers (in the form of FM stereo simulcasts) and to discard the others. The cable company in my area only provides excellent FM simulcasts of MTV and the Movie Channel and a weak and noisy simulcast of HBO.

Freedom of choice. With a TV antenna you can pick up six or seven local stations, each of which tries to appeal to a broad market of viewers. By subscribing to cable TV, you may get 20 to 40 channels, including a few with more specialized programming, and with luck some of those will appeal to you. But in either case, programming choices are imposed on you by the middlemen from whom you get your TV signal. Most cable-TV systems pass on to their subscribers only about half the varied channels of programming raining down from the satellites.

The cable company in Medford, for instance, devotes a channel to a French-language station from Quebec but refuses to carry the Financial News Network (daily business news and a stock ticker from Wall Street). I get movie soundtracks in great stereo, but concerts on the Arts/Entertainment channel arrive in mono, and the Bravo channel, which has even more concerts, is not offered at all. A friend who lives about a mile away and deals with a different cable company gets the concerts on Bravo but can't get stereo sound with movies. Cable systems are upgrading their channel capacity to provide more (and more specialized) programming options, but the number of satellite channels is growing even more rapidly.

With a satellite receiver you get to make your own choices. For concerts and plays you can have *both* Bravo and Arts/Entertainment, both with stereo sound. There are two channels of full-time children's programming, two adult-education channels with home-study courses for college credit, two channels of business news, the NASA channel (with full coverage of shuttle and other space missions), the Black Entertainment channel, which runs films and specials featuring black performers, two Hispanic channels, two country-and-western channels, three channels of hard-core sex, a dozen sports channels (including three devoted to horse racing), a dozen channels operated by religious groups (nine Protestant, two Roman Catholic, and one Jewish), three channels of '50s and '60s reruns, and an endless array of movies. Why settle for half a loaf (that is, cable), when you could have the whole thing? As a bonus you'll also get the network feeds without the annoying promotional interruptions and voice-overs that local stations add. So whatever benefits cable-TV may promise in picture quality, viewing flexibility, and stereo sound, satellite TV delivers two or three times over. A satellite dish is the ultimate treat for a videophile.

* * *

If satellite systems are so wonderful, why don't we all have them? A million dish owners is an impressive number, but that's still fewer than one household in 50, and the majority of those are west of the Mississippi. Only a paltry three percent are in New England, partly because cable service is so widely available here. Satellite dishes have spread most rapidly in areas where TV stations are far apart and cable service is simply unavailable — for example, in the plains of Kansas and the valleys of West Virginia. But there's a second reason for the lack of satellite systems in New England: good satellite reception is more difficult and costly to obtain in the Northeast, especially in cities, and in some places it can't be done at all. If you decide to install a system, here are the obstacles you'll have to deal with.

Aiming. If the satellites were suspended in the sky directly overhead, receiving their signals would be child's play. But their orbits are above the equator, so at Boston's northerly latitude the best we can hope for is that the satellite will be located in the sky no more than halfway down toward the southern horizon. A few are, but the section of the equatorial orbit directly south of us is already crowded with the satellites used for military and civilian communications (telephone et al.). Consequently, the satellites that carry the largest number of television programs are farther to the west. Specifically, the two most-watched TV satellites, the Hughes Galaxy 1 and the RCA Satcom F3, are stationed above a spot in the Pacific Ocean 2500 miles southwest of Los Angeles.

From our viewpoint, in the extreme northeastern corner of the US, this places those satellites very low in the southwestern sky, only 13 degrees above the sea-level horizon. At such a low elevation there's a very good chance that the line-of-sight view to the satellite from your backyard will be blocked by buildings and trees. To find out, wander around your property late in the afternoon, just before sunset, and note the sun's location in the sky. As the sun sinks into the Southwest, does it set behind distant mountains, or is your view of the sunset blocked by buildings and trees only a hundred feet away? The major TV

The sum of its parts

The dish. Informally, everyone refers to the big, saucerlike thing as an antenna. Strictly speaking, it is not. It is a mirror — a curved surface that reflects TV signals, gathering TV energy over a large area and focusing it into a small spot. The actual antenna is a small tuned wire located within a "feedhorn" that is mounted at the reflector's focus.

LNA or LNB. Each satellite transmitter produces only a few watts of power, and it is 22,000 miles away, so the signal arriving at the ground is exceedingly weak — about a billionth of a trillionth of a watt. Satellite receivers were made possible by the development of signal amplifiers of exquisite sensitivity. Circuits that just a few years ago cost upwards of $10,000 are now being mass-produced for $500.

A satellite system that will be used to tune only one channel at a time will employ an LNA (low-noise amplifier) to strengthen the signal and convert it to a UHF frequency for its trip from the antenna into the house. For people who want to record one show while watching another, new satellite systems use an LNB (low-noise block converter), which converts all of a satellite's 24 channels into as many UHF frequencies. When the signal gets into the house it can be split between two satellite-tuning receivers — one for the TV set and one for the VCR.

The useful sensitivity of an LNA or LNB is specified not in volts or watts but in degrees. This measure is arrived at by computing what the temperature of an ideal resistor would have to be in order to generate the same amount of electrical noise as the circuit does. The lower the temperature, the lower the noise and the better the effective sensitivity.

This, in turn, determines how large the satellite dish must be in order to overcome the circuit noise and deliver a snow-free video signal. A few years ago, when 120° was a typical LNA rating, New Englanders had to use dishes 16 to 20 feet in diameter. Now that LNAs and LNBs are available with 80° ratings, a 10-foot dish can bring in a good picture.

Receivers. The receiver sits on the TV set and tunes the 24 channels ("transponders") on each satellite. Tuning may be done with push buttons, a rotary switch, or a remote control. The receiver may also have a signal-strength meter (to help you aim the dish for strongest signal), fine-tuning controls for video and audio, a polarity-inverting switch to undo the simplest form of signal scrambling, "discrete" and "matrix" circuits for stereo decoding (different systems are used on different satellites), and a final output that feeds the selected signal to your television set via Channel 3.

— P.W.M.

satellites are located in the sky about one hand's breadth to the *left* of where the sun sets.

If you decide you want your own satellite dish, your dealer's first act (after checking your credit rating) will be to do a site survey with a compass and sighting instrument to find out for certain whether you have a clear line of sight to the satellites from your property. If the only obstruction is a tree, perhaps you can persuade — or pay — its owner to cut it down.

The obvious way to overcome many obstructions is to install the satellite antenna on a rooftop, from which it will have a clear view of the entire sky. But that increases the cost of the installation, makes the dish more vulnerable to high winds, and makes it a more visible eyesore, which could arouse the ire of your neighbors or city zoning commission. If you're an apartment dweller, any location for a satellite dish is likely to require negotiation with your landlord.

Terrestial interference. Look up at the roof of the Prudential tower or any other tall building, and you're likely to spot a number of dish antennas. These are used by the telephone company, government, banks, and other businesses for microwave transmission — for carrying telephone conversations, computer data, and local television signals from point to point and city to city. Often these signals are at the same frequencies as those used for satellite TV. If your rooftop or backyard happens to be in the path of a microwave signal, it may wipe out your satellite reception on one or more channels.

That's not likely in a rural valley, but it is a common problem in the city and inner suburbs. Before you sign a purchase/installation contract, you may want to ask your dealer to set up a temporary dish to confirm that you can get good reception. And since new interference may spring up later, urban buyers should probably select a satellite receiver that has a provision for plug-in filters to combat terrestial interference.

Dish size. As Dorothy discovered, Kansas isn't as colorful as the Land of Oz, but it is sure a great place for satellite TV, because the major US TV satellites have their transmitting antennas aimed squarely at the geographic center of the continent. In New England we're in the fringe area, where signals are only half as strong; in order to get clear pictures we need a dish with twice as much signal-collecting area. Eight-foot antennas like those in the new Radio Shack system are okay for Texas, but for Boston the optimum size is about 12 feet across.

That has several unfortunate consequences, starting with cost. The bigger dish will cost about twice as much to buy and twice as much for delivery from the factory. With four times the surface area of the smaller dish, it weighs about four times more and therefore requires extra manpower for its installation. It also requires a proportionately stronger mounting to support and aim it. Because of the big dish's large area, the wind exerts four times as much force on it as on the smaller one. This poses problems in bad weather: it's difficult to keep it aimed accurately at a satellite during ordinary storms and difficult to keep it anchored safely in a gale or hurricane.

Obviously this limits your flexibility of installation. In the Southwest, satellite viewers are mounting eight-foot dishes on roofs and even bolting six-foot dishes on apartment balconies. But the recommended installation for a 12-foot dish comprises a heavy pipe mount buried securely in a base of poured concrete. On the flat roof of an apartment building, the dish mount can be bolted to the building frame. But if you mount a big dish on the roof of a wood-frame house, you'd better be sure that both the dish and the roof are securely anchored; unlike Halley's comet, Hurricane Gloria was not a once-in-a-lifetime event.

Dish construction. Professional users, such as cable-system operators, nearly always employ solid-metal (steel or aluminum) dishes that are usually coated with fiber glass. Among home users, the open-mesh design is rapidly becoming popular because it is much lighter in weight and less affected by wind. (Solid dishes weigh up to half a ton, whereas some mesh dishes weigh less than 100 pounds.) This simplifies installation, permits the use of a cheaper mount, and makes roof mounting a practical possibility.

At the C-band (4GHz) frequencies that are currently used for satellite TV, there is little difference in performance between the two methods of dish construction — as long as they are made to the same standard of accuracy and adequately braced to retain that accuracy during years of use. The reflective surface of the dish must follow a precise parabolic curve to within a fraction of an inch. If it warps during winter's cold and summer's heat or sags under the weight of snow and ice, the picture will become grainy. In some areas you may also have to worry about whether the dish will attract vandals.

The strongest argument in favor of a solid dish is that it can also be used for Ku-band (12GHz) satellite TV. That's not very important now, but it promises to grow in significance, and by 1990 it could become the dominant form of satellite TV. Of course, when (and if) that happens, you'll be able to buy a three-foot Ku-band dish at a fraction of the cost of today's large solid dishes.

Mounting. All the American and Canadian broadcast satellites are located in the Clarke belt, an orbital zone 22,000 miles above the earth's equator. There, as first proposed by Arthur C. Clarke in 1945, each satellite's orbital speed carries it around the world in exactly the 24-hour period of the earth's own rotation, so the satellite seems to be permanently suspended at one spot in the sky.

That simplifies the installation of the satellite dish. In principle all you need is a simple "az-el" mounting, which will let you adjust the antenna's aiming point both left/right (azimuth) and up/down (elevation). Fine tune the aiming until you get the strongest and clearest signal from the satellite, lock the antenna in place, and you're done — if you're willing to limit yourself to watching the channels on one satellite.

But you probably aren't. After you discover the picture quality and programming variety on one satellite, you'll want to see some of the dozens of channels on other satellites, too. For that you'll want a "polar" mount, one whose axes are tilted back to match the arc that the Clarke belt makes across the sky. This arc is similar to the path that the sun follows from east to west each day, but the Clarke belt is a few degrees closer to the southern horizon.

You could get a cheap polar mount equipped with a hand crank for re-aiming the dish from satellite to satellite, but you'll regret that choice the first snowy January night you have to go out in your pajamas and wrestle with the crank. The sensible, if expensive, solution is a polar mount with a remote-control "actuator," which lets you re-aim the antenna from the comfort of your chair. The best systems contain a microprocessor that re-aims the dish automatically as you change channels.

Installation problems. If your house faces north or east, you can hide the dish in your backyard, assuming that you have an unobstructed view of the southern horizon from there. But if your house faces south or west, the house itself will obstruct the view from your backyard, forcing you to put the dish out front. Are you willing to do that, and will your neighbors let you? If the dish is a big one, will you have to apply for a variance from the zoning commission to install it? Even with roof mounting, a large dish is likely to be controversial.

Some dish owners have successfully argued in court that since other homeowners adorn their roofs with TV antennas, it is their right to choose an antenna of a different shape. This argument may succeed with a satellite antenna of modest size and see-through open-mesh construction, but it may not work so well for a big white saucer that looks like a new arrival from Venus. In an apartment building you may have only one obstacle to deal with: your landlord, whose approval you'll surely need if you hope to install a dish on the roof. If the owner lives in the same building, one way to obtain that permission is to feed satellite programs to his TV.

The cable that carries the signal into the house from the dish should be protected from the weather, usually by a sealed conduit of plastic pipe. If the dish is to be mounted in the yard at some distance from the house, the installer will have to dig a trench for the conduit, taking care to avoid existing underground water, sewer, and gas pipes as well as other wiring.

A satellite receiving system is an exciting, if major, investment. I can't install one because I don't have a clear line of sight to the southwest, but when I decide to move, it certainly will be part of my planning. □

Satellite programming

Here's a listing of what you'll get on the three most popular satellites:

HUGHES GALAXY 1

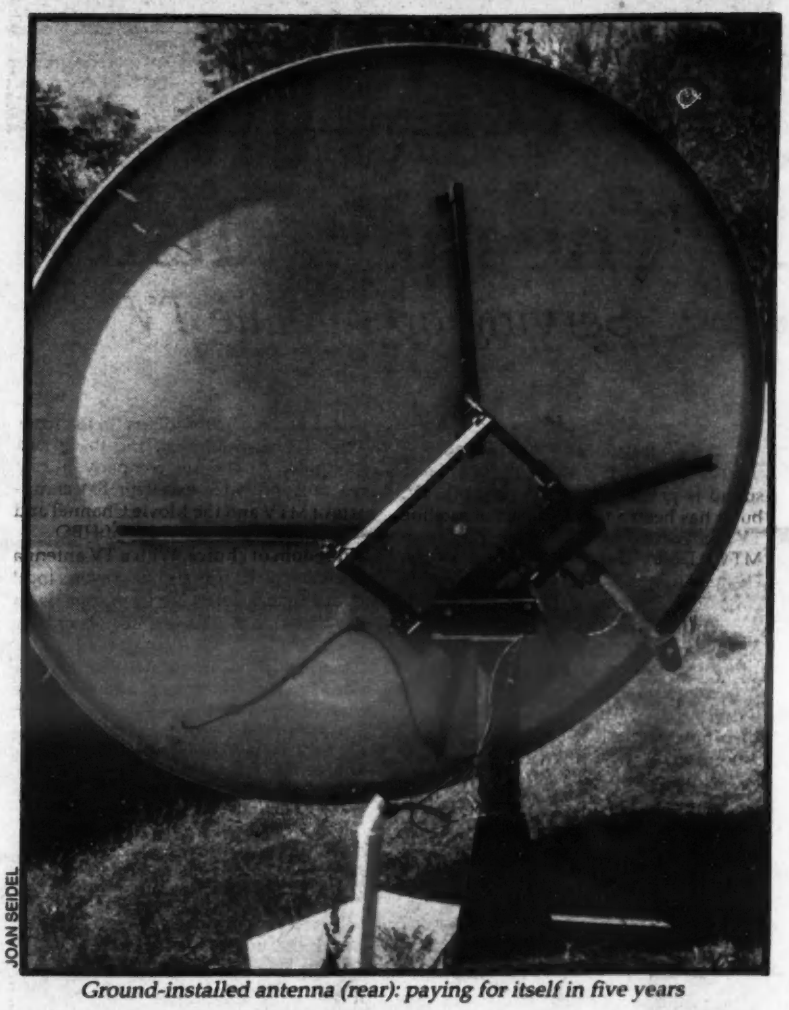
Channel
- 2 The Nashville Network, in stereo
- 4 The Disney Channel, in stereo
- 5 Showtime (movies etc.)
- 6 Spanish International Network
- 7 CNN (news)
- 8 CNN Headline News
- 9 ESPN (sports around the clock)
- 10 The Movie Channel, in stereo
- 11 CBN (family and religious)
- 13 C-SPAN (US Congress)
- 15 WOR (New York)
- 18 WTBS (Atlanta)
- 19 Cinemax (movies)
- 20 Galavision (Spanish-language)
- 23 HBO (movies and specials)

RCA SATCOM F3

- 1 Nickelodeon (for children)
- 2 PTL (family/religious)
- 3 WGN (Chicago) plus WFMT (stereo)
- 4 Financial News Network
- 6 SPN (movies, reruns)
- 9 USA (sports, reruns)
- 11 MTV (rock videos, in stereo)
- 13 HBO
- 15 VH-1 (milder rock videos)
- 16 The Learning Channel
- 17 Lifetime (talk shows)
- 20 Black Entertainment Television
- 21 The Weather Channel
- 24 Arts/Entertainment (concerts, plays)

RCA SATCOM F4

- 2 Bravo (foreign films, concerts), in stereo
- 3 Cable Sports Network
- 5 ABC network
- 6 Madison Square Garden (sports)
- 10 American Movie Classics
- 12 Playboy (sex, talk, jazz concerts)
- 13 New England Sports Network
- 15 Biznet (business news)
- 16 Silent Network (signed for the deaf)
- 19 WPIX (New York)



JOAN SEIDEL

Ground-installed antenna (rear): paying for itself in five years

The scrambling threat

The unanswered questions hovering over the satellite business all have to do with scrambling. When will scrambling begin? How many channels will be affected? What changes will it bring? How much will it diminish the appeal of owning a satellite dish? Scrambling is coming soon — not to all channels but certainly to some.

Cable operators fear a loss of income if satellite dishes become popular. The major purveyors of premium-cost cable services — HBO, Showtime, and the movie studios — have always resented the idea that dish owners could watch cable programs without paying for them. (There seems to be an element of hypocrisy in this position, though: HBO has repeatedly rejected proffered payments from rural dish owners who are out of the reach of cable.) Together, these producers and distributors have tried to get Congress to outlaw privately owned satellite receivers. Back in 1979, though, the FCC reaffirmed the traditional right of citizens to receive broadcast signals, with two restrictions: the signals cannot be resold, and if private communications are intercepted, they can't be disclosed publicly.

Congress finally settled the argument by legislating a compromise in last year's cable deregulation law. It's in two parts: (1) reception of satellite signals is *not* piracy — it is perfectly legal; (2) producers who want to restrict reception can scramble the signal, and it will be illegal to decode such signals without paying for them.

HBO and Showtime have been conducting scrambling experiments for about a year, and a system probably will go into effect in 1986. After that, dish owners who want to see these channels will have to buy a decoder and pay a monthly fee similar to that paid by cable subscribers. It's not clear yet how many other satellite channels will be scrambled, and whether they will use the same method instituted by HBO and Showtime.

If all the most popular channels are scrambled, will the cost of decoders and fees undermine the appeal of the backyard dish? Maybe, but there will still be dozens of unscrambled channels, plus the continuing attraction of perfect pictures and stereo sound.

— P.W.M.

Picture perfect

The promise of high-definition TV

by Mark P. Fishman

For the past five years people have been hearing that "high-definition television will be available in the home within the next five years." What is high-definition television, and why isn't it here yet?

High-definition television (HDTV) refers to improvements in picture detail, image size, and overall image quality that approximate or exceed the quality most people associate with 35mm film. For several years such improvements have been technically feasible, as demonstrated over closed-circuit systems — using wires, not broadcasts — by CBS, NHK (the Japanese-government broadcasting authority), and by several European firms. But so far the systems are incompatible not only with each other but with present-day receivers as well. And therein lies part of the answer as to why we've had to wait so long.

Let's start with a little history. Those of us with an interest in audio equipment will recall that major changes in methods of recording sound have occurred, quite regularly, at about 20-year intervals: digital audio in the '70s; stereo LPs in the '50s; LPs (experimentally) in the '30s. Yet the pace of video — of television — development has been much slower and more erratic. Since the introduction of black-and-white television in the '30s, there has been only one major change: color broadcasting, which was introduced in the '50s. Surprisingly, our 50-year-old television system is still pretty good. With proper attention to quality at the studio and in the home, in fact, there isn't much wrong with the pictures we get. And that's another reason it's taking so long to advance beyond the industry standard.

Furthermore, in order to succeed in the marketplace, every new breakthrough in home entertainment requires some measure of compatibility with the already existing technology. Our color TV system, for example, was a remarkable achievement: it permitted the transmission of full-color images over the same TV channels that broadcast black-and-white images, and it was fully compatible with pre-existing receivers. Someone with an old monochrome set could watch the new color programs in black and white without being aware that the signal was different, whereas the new color sets could pick up the monochrome programs and show them in black and white.

HDTV development is a victim of the chicken-and-egg syndrome: why should we buy a new product that can't play the old program material if the new material isn't available yet? And why should a company make new programs if no one can play them yet? Only when new players and new programs can be used with old programs and equipment will consumers get the improvement promised by HDTV. And that improvement had better be a substantial one, or most people won't care enough to bother with it.

Current TV standards were built on compromises between the eye's ability to discern detail and the need to conserve the frequency spectrum to accommodate many broadcast channels. The TV picture's ratio of width to height was originally chosen to match that of Hollywood films, and the later addition of color had to be invisible to people without color sets. When the National Television System Committee (NTSC) recommended the color system we now use, no other country had color TV. There were no communications satellites, so there was no question of incompatibility with the TV systems of other countries. The French, however, decided not to adopt an American system, and the Germans wouldn't let Europe adopt a French one, so the world now has three incompatible systems. Any changes in our TV system, therefore, have to preserve compatibility, not only with 300 million US TV sets, but also with the two other worldwide standards. No one favors three incompatible HDTV systems, but then no one wants to adopt a system developed elsewhere.

The promise of HDTV lies in the improvement of the current aspect ratio (that is, width-to-height ratio) of 4:3 to a more CinemaScopelike 5:3, or even 2:1, as well as in a doubling in resolution. While we're waiting, though, NTSC performance can be improved upon with sharper, cleaner images, without our having to throw away existing transmitters and receivers. Image resolution — the fineness of detail — is limited, ultimately, by the channel bandwidth allocated for the transmission. Because TV scans each picture (unlike film, which presents a succession of whole pictures), the resolution limit depends on the relationship of several factors. One is the number of pictures transmitted per second; another is the number of lines transmitted per picture; the third is the number of allowable variations from light to dark per line (these variations are called picture elements, or pixels).

The NTSC standard calls for a 525-line picture. The image is scanned from left to right, starting at the top, and each successive left-right scan comes a little lower in the frame, until the picture is complete. This process is repeated 30 times each second. Because the eye will detect a flickering image when the process repeats itself fewer than 45 times a second, our system actually uses a technique called *interlacing* rather than progressive scanning. If you were to number the scan lines, top to bottom, from one to 525, half would be odd and half even. An interlaced picture transmits all the odd-numbered lines first, and then goes back to the top to transmit the even ones and place them in the spaces between the odd lines. These odd and even fields can be transmitted at a rate of 60 fields per second, but you still get only 30 frames per second. The eye sees no flicker, and the frequency requirements remain the same.

Toshiba's CZ-2094: paving the road to high-definition TV

Unfortunately, the price of an interlacing system is paid in vertical resolution. Experiments have shown that the human eye does not perceive the full resolution of an interlaced picture, particularly of moving images that have been displayed between the odd and even fields. The resolution seems to decrease to between 50 percent and 70 percent of its potential. So our interlaced TV pictures appear about half as sharp as they really are (at least vertically).

Sony Corporation has demonstrated a system called the Scan Doubler that captures both odd and even lines and stores them digitally in a computer memory so that all 525 lines can be shown twice in a progressively scanned picture (twice because the next complete image won't be available for a full 30th of a second, and it still needs to avoid flicker). The Scan Doubler, then, very nearly doubles the apparent vertical resolution of the TV picture; and since it works entirely inside the receiver, it requires no frequency change at the broadcast end. But we can't buy it yet. One reason may be the amount of memory and computer power necessary to make the Scan Doubler work. There are about nine million pixels in an NTSC frame. When they are digitized, information about brightness and color (hue and saturation) must be stored. Plus, the system must make compensations to avoid ragged vertical edges on objects that move quickly from field to field and to smooth apparent motion from frame to frame. (No one wants to look at objects that stay in one place for a 30th of a second and then jump suddenly to a new position.) The Scan Doubler is a start, but it requires further drops in the price of computer memory and processing power before it can be commercialized.

One innovation that grew out of efforts to adapt the color signal to the bandwidth of the monochrome was *composite video*. To understand how this works, we must first understand a little theory. Repeated signals are composed primarily of frequencies at multiples of the repetition rate, much like musical tones have harmonics. Since a TV signal of a stationary scene doesn't change from field to field, it is going to be composed primarily of frequencies at 60-Hz (the field repetition rate), 120, 180, and on up the spectrum at 60-Hz spacing. The higher frequencies, which represent the fine detail of the picture, contain less energy than the lower frequencies. So if you were to draw a graph of the energy (vertically) at each frequency (horizontally), you'd get something that looks like the teeth of a comb, with the teeth on the right (high frequency) shorter than those on the left. Composite video works by putting the information about colors in between the teeth representing brightness. By taking advantage of this empty space, it doesn't need extra bandwidth. The process is called *interleaving*. Now the only problem is separating the information again. Normally two overlapping bands of frequencies — like noise and music on a record — can't be separated by simple filters.

The proper way to segregate color and brightness information is to use a filter whose frequency response also looks like a comb. Comb filters can be made with analog circuits, but the easier and cheaper way is to digitize the signal with a dedicated computer. (I hope you are beginning to see a pattern.) Once the image begins to move, the interleaving can no longer be done perfectly, but digital filtering can separate the information more cleanly than was possible before. And once the signal is in digital form, other digital processing becomes economical.

One phantom product that relies on digital signal processing is (appropriately) the "ghost eliminator." It has been several years since Matsushita, one of Japan's largest electronics firms, introduced this idea at a Consumer Electronics Show, but we still can't buy a TV in the United States that incorporates it. The idea is to detect the delayed signal caused by reflections from buildings and other objects and to subtract it digitally from the received signal to eliminate ghost images. Like the Scan Doubler, this product must rely on advances in computer technology to become affordable.

Strictly speaking, ghost elimination is not a step toward high-definition TV, but the digitization of images is. Whereas the current distribution system can't fully handle digital television transmission, digital processing in the receiver can be used to control the decoding of color, scan the image more accurately, interpolate in order to smooth edges and make the scan lines less visible, and generally keep the set operating at its maximum performance level.

ITT has finally released a set of integrated circuits that include all the standard TV video processing functions in digital form. Right after the tuner, the signal is digitized. Color decoding, hue correction, scanning synchronization, and brightness and contrast adjustments are all achieved digitally. Toshiba has started to use ITT's integrated circuits, and one Toshiba television set (CZ 2094) is already taking advantage of the digitized signal to inset a small black-and-white picture from a second channel in a corner of the first channel's color picture. This is useful for monitoring commercials on the second channel if you're, say, taping a program you aren't really watching or for closed-circuit viewing of another part of the house such as the nursery, or for watching two football games simultaneously. You don't get sound on the second channel, though.

At the production and broadcast end, digital videotape recorders and cameras and digital communications systems can help prepare for the arrival of true HDTV. Since digital-signal processing is so flexible, programs recorded with an aspect ratio of 2:1 and 1125 lines per frame (almost twice the current number) could be broadcast by digitally selecting only the usable portion of the image (4:3, 525 lines). The same tape could be applied when HDTV receivers and distribution become available.

Now we come to the major obstacle to true HDTV: politics. To send an analog TV signal between countries (by satellite or by tape) requires that the signal first be converted from, say, the German PAL system to the American NTSC. This involves a change in the encoding for color, an increase in the number of frames per second, and a decrease in the number of lines per frame. Such changes not only degrade the image quality but are very expensive besides. Before there can be one worldwide standard for high-definition television, there must be only one worldwide standard for digital videotape and production. Obviously, the standard must also allow for easy conversion from the digital format to all present-day transmission systems. And it should accommodate film production as well as TV work.

Indeed, movie production will continue to be the driving force behind the development of HDTV. With no immediate prospect for home use, HDTV is being looked at as a substitute for film in producing theatrical features, and the needs of the movie industry, therefore, have become very important in establishing acceptable standards. Movie producers would eventually like to work with something less expensive than film — but only if the quality is comparable. As for home use, because any HDTV system will need greater bandwidth than the NTSC system requires, two distribution methods likely to be used are vastly improved cable systems, and "direct broadcast from satellite" (DBS), which will use small, affordable dish antennas and high-power satellites in new frequency bands. (Don't confuse this with the 12-foot dishes that some people already use to get ordinary TV signals from current satellites, which were not *intended* for home use, at least not by the broadcasters).

All of this would be a lot to ask for, even if the challenge were only technical. But it isn't. The frequency allocations required to set up those satellites are controlled by an international agreement that is subject to review every few years. Some countries think that the developed West has too much of the spectrum already, and the prospect that individual citizens may be able to receive information from neighboring countries, or from satellites, scares some governments silly. But at least the technical obstacles to digital videotape have been overcome. There are several proposals for a high-definition-broadcast format that would either permit complete compatibility or require an inexpensive add-on box to the antenna to receive new programs in the old format. So now it's up to the politicians. Maybe in five years. □

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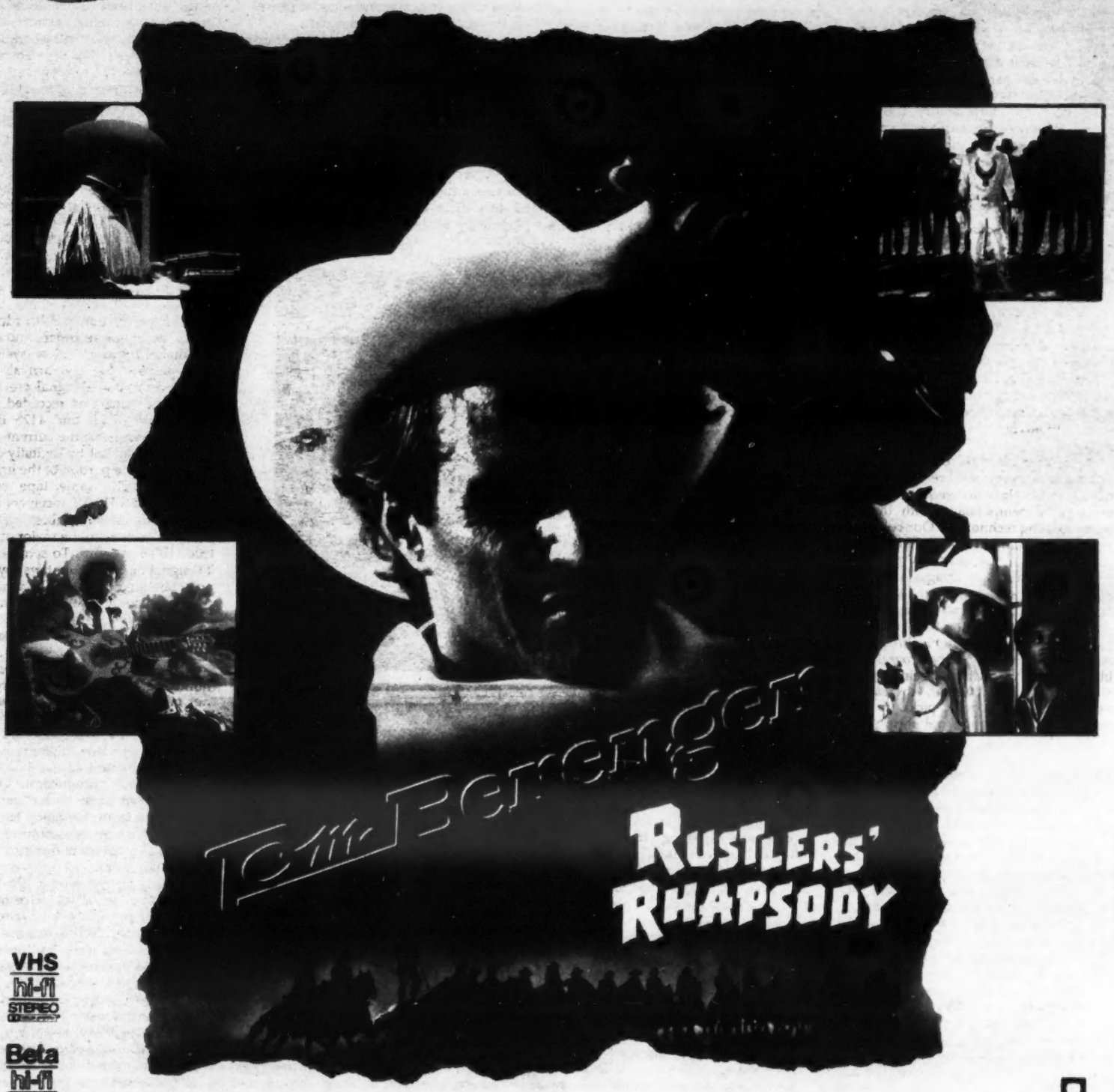

VHS hi-fi STEREO

Beta hi-fi STEREO

HOME VIDEO

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The control center of RCA's Dimensia system: design for the sake of convenience

The first Dimensia

RCA shows us the future

by Alan Radding

There is a widespread vision of the consumer-electronics future that looks something like this: a large television will be the centerpiece of the totally electronic home. Connected to the system will be the telephone, home computer, thermostat, security alarm, large and small appliances, lights, automatic garage-door opener, and anything else that makes utility companies yearn to build giant power plants.

In this vision, when you finish watching *St. Elsewhere*, you tell the electronic controller that you are going to bed after the 11 p.m. news, that you want to be awakened at 7 a.m. the next morning to the soothing radio sounds of Robert J. Lurtsema on *Morning Pro Musica*, and that you plan to breakfast on toast and coffee while watching the *Today Show*. At 8:15 a.m., you tell the controller, you will leave for work. You preload bread in the toaster and coffee in the coffee machine, trot off to bed, and the computer handles the rest.

At 6:30 a.m., your thermostat resets itself to the daytime level, and the water heater readies the morning's water supply. Precisely at 7 a.m. your bedroom clock radio goes off, and Robert J. gently nudges you awake with bird songs and an obscure Telemann flute concerto. While you're showering, the coffeemaker kicks on. Still not fully awake, you stagger into the kitchen, greeted by the aromas of freshly brewed coffee and toast. The TV is already on, tuned to the *Today Show*. Before you leave for work, your day's schedule, the overnight additions to your electronic mailbox, and a scan of your voice-message telephone system are displayed on the TV screen. Your car has already been electronically started and warmed up when you slide into the driver's seat. The garage door opens on cue.

You've probably heard any number of variations on this home-electronics theme. Depending upon who is reciting it, your personal computer or telephone may also act as the central controlling device. From a technical standpoint, such a scenario can be easily played out in today's laboratories — it really isn't such a big step away from the video-cassette recorder that turns itself on and off automatically to record different events over a two-week period or a microwave oven that cooks a three-course meal while you're fighting your way home in rush-hour traffic.

The trick is to connect the central addressable control circuitry to each home device you want centrally operated and to wire it all together in such a way that the correct signal feeds the corresponding device. And if those of us who get flustered by automatic teller machines are to handle this system successfully, it must be simple to set up and operate. No OPEN, #8, 05A0630, HT commands for us.

Although the technology is not exotic, RCA is the first major consumer-electronics company to think it through and apply it to a mass-produced consumer product. (Other companies reportedly have similar systems under development.) RCA's Dimensia system hooks a large-screen TV, a video-cassette recorder, a CD player, an AM/FM tuner, a cassette deck, a turntable, and all the appropriate amplifiers, equalizers, and speakers into a single unit mounted in three cabinets and controlled by a 52-button remote control. The purpose of Dimensia is audio and video home entertainment, but RCA could have just as easily connected almost anything electronic to the system, and, through auxiliary inputs, it still may. In fact, in an early demonstration for RCA dealers, Dimensia was shown operating a toaster (which had to be modified with logic and control circuitry) as an example of the system's extensive capabilites. But, since its introduction in September 1984, Dimensia has undergone changes in its configuration and price structure, as RCA struggles to overcome lackluster sales. The basic complete system now lists for about $5000; a larger, more powerful system costs around $6000; and now the company is applying the same integrated-control technology to other, less costly, (audio) systems, called Digital Command Components.

Initial reports on Dimensia implied that RCA actually manufactured the entire system itself in the US; in fact, nearly all the components are made by the Japanese company Hitachi (only the television is made by RCA). RCA planned and designed Dimensia, perfected the addressable single-remote-control concept, and applied it to the components in the system, but, like most other consumer electronics, the actual manufacturing is done outside the country.

In general, audio- and videophiles have given the system passing marks for its video performance, but failing grades for its audio capabilities. Even with the optional upgraded components, they complain, Dimensia is a mass-market consumer item that can't deliver the level of performance demanded by audio and video purists. Indeed, true purists resent the concept of packaging components together in the first place. "It takes away all the creativity in selecting the exact products to fit your needs," says high-end audio and video consultant Walter Swanbon, a partner in Audio Vision, in Arlington. However, until the day all components from all manufacturers come with standard addressable-control circuitry, RCA has no choice but to package Dimensia with preselected components.

The other problem Swanbon has with prepackaged systems is that every person and every room require different performance characteristics. The system as configured, for example, makes no attempt to create "surround-sound," which is usually a standard feature of the high-end custom audio/video rooms Dimensia tries to emulate. Yet a close look at Dimensia suggests that RCA was more interested in integrating good mass-market components under the control of a single remote device than in creating a top-end audio and video system to rival customized sound rooms, where each piece is selected solely on the basis of specific performance characteristics and even the architecture of the room undergoes acoustic modifications. So, given that the objective was to create the first audio and video system linked to a single remote control, the result is impressive, however vigorously one chooses to debate the intrinsic worth of such an objective.

What RCA did was put an addressable electronic control circuit into each component. One dealer describes it as being much like putting a computer into each component, but don't expect something you might run Zork on, with a keyboard and lots of random-access memory. These are computers in the technical sense, circuits with input, output, limited memory, and processing capabilities. To make the system work, the components are "daisy-chained," each one cabled into the other through a system of color-coded jacks and inputs. But this is only true of the external cables. Actually, Dimensia operates as a parallel electrical connection made through a five-wire flat cable, which RCA calls SystemLink. SystemLink is a two-way data bus that allows the central controller in the receiver-monitor to send and receive signals from each unit. The fifth wire carries the addressable codes that instruct the components in the system to pay attention to or ignore the incoming commands. As many as 16 components may be controlled simultaneously.

Completing the integrated control system is the hand-held remote-control device itself. The 52-button device looks like one of those intricate scientific calculators that have replaced the slide rule and the plastic pocket protector as the hallmark of the science nerd. Although it appears complicated, the remote unit is easy to master. Controls are grouped together logically into major-media selections, video-cassette functions, video special effects, channel and station selections, volume control, and system status functions.

You start Dimensia by turning on the video monitor-receiver (the TV), which is the master controller. When you select a medium, such as the CD player, the controller automatically turns on the appropriate components, in this case the integrated amplifier as well as the CD player. With each command, a brief message appears on the screen, telling you what's being done (or, if there's a problem, telling you what it is). An attempt to play the VCR without a cassette loaded, for instance, will result in an instruction to load a cassette. You can bypass the TV screen if you only want to listen to music, but in that case you will not see the screen messages. You can also run several functions simultaneously, such as listening to music while watching a ball game on TV, recording a program from another channel on the VCR, and recording another audio broadcast on the audio cassette deck. You can do it all through the remote control or operate any unit directly.

Although Dimensia's remote-control capability is excellent, it doesn't do anything to improve the quality of the system's audio and video performance. It's really nothing more than another of those flashy advances in technology that fall into the "Gee whiz, look what I can do" category. So don't be distracted by the bells and whistles. Dimensia is still an audio and video entertainment system, and the individual components should be evaluated with the same care you would bring to any unpackaged set-up. In a moment of frankness, one dealer warned, "It doesn't sound as good as its specs." Maybe, but let's look at the system piece by piece.

Dimensia's basic color monitor, which incorporates the main control circuitry, is the key component. The 26-inch model is the ordinary direct-view picture tube with a square screen. It is as good a high-end television as you'll find anywhere. A monitor receiver simply means that the component can receive signals other

Continued on page 10

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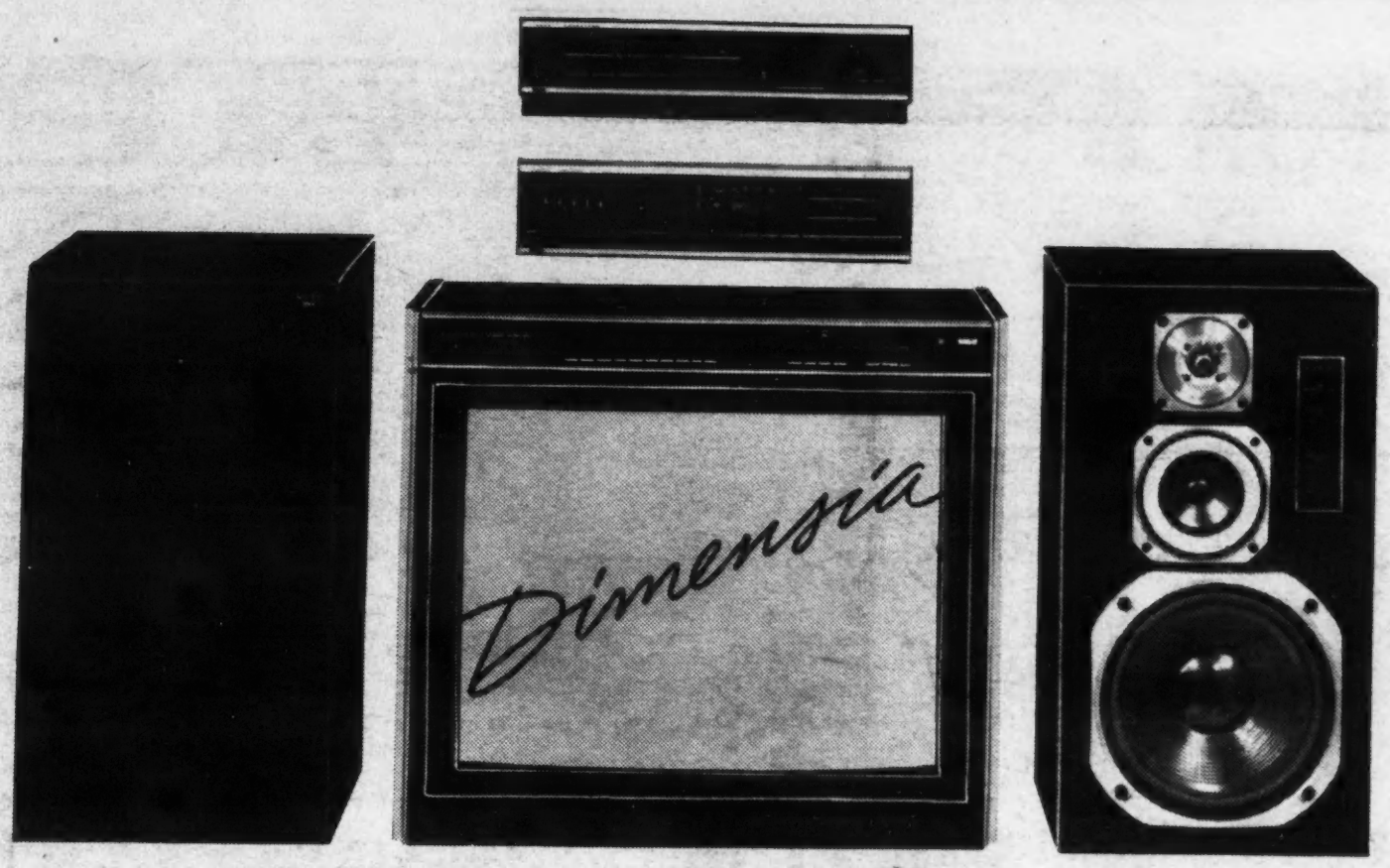
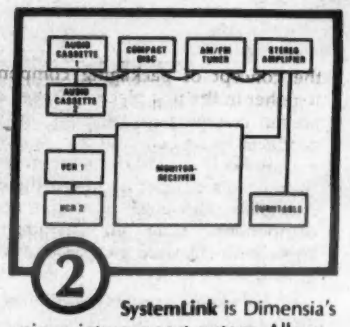
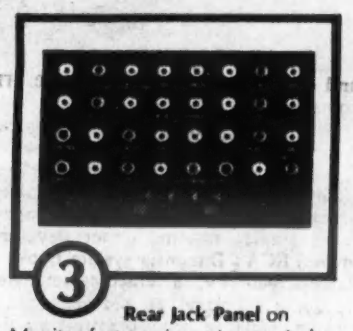


Why DIMENSIA is the world's most advanced audio/video system.

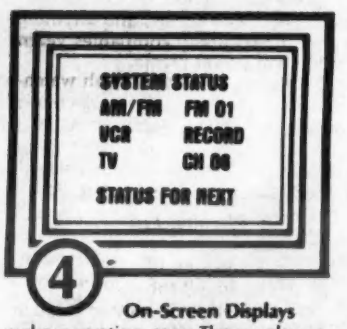
1 **Dimensia Command Center** provides direct push-button control of Dimensia components from your easy chair. Included with Monitor-Receiver which acts as system's central switching intelligence.



2 **SystemLink** is Dimensia's unique interconnect system. Allows you to connect most components in "daisy chain" fashion as shown above instead of running all connections to amplifier.



3 **Rear Jack Panel** on Monitor features input/output jacks which link all compatible devices. You can access several audio/video devices remotely, and Monitor's "intelligence" will do the rest.



4 **On-Screen Displays** make operation easy. These color-coded displays enable you to check the status of any system component and even prompt you when further instructions are needed.

Get started with the Dimensia System shown above.

26" diagonal Monitor-Receiver
RCA's exclusive Full Spectrum chassis processes 100% of the audio/video signal including stereo TV. Interacts with other components to give you complete system control. Choice of oak or ebony finish. (DVM2600/2601.)

VHS Hi-Fi Stereo VCR
Superb performance from five video heads, two audio heads, with stereo sound that approaches compact digital disc quality. Remote programming with on-screen cues. Jitter-free special effects. (VKT700.)

AM/FM Stereo Receiver
50 watts per channel (RMS minimum rating, into 8 ohm loads, at 20-20,000 Hz, with no more than 0.05% THD). Memory for up to 16 pre-set stations. Graphic equalizer with 5 bands. (MSR150.)

3-Way Speaker System
11" polypropylene cone woofers, 4" polypropylene midrange, 1" cloth dome tweeters. Air suspension design. Frequency range: 35-20,000 Hz. Choice of oak or ebony finish. (SPK375.)

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- MVR975HF Convertible VHS Hi-Fi VCR
- MSA200 100-Watt Integrated Amplifier
- MSA100 50-Watt Integrated Amplifier
- MAT110 AM/FM Tuner
- MGE160 Graphic Equalizer
- MTR120 Auto-Reverse Cassette Deck
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Dimensia

Continued from page 8

than broadcast ones and output to something other than its own screen. Dimensia offers 33 input/output jacks and digital RGB (color) inputs in case you want to hook the screen up to your color computer.

The 40-inch (measured diagonally) screen that goes with the more powerful system differs from the basic model in one significant way, besides size: it is a rear-screen projection design instead of a direct-view unit. Direct picture generally results in a better image than rear-screen projection because rear-screen requires a precisely aligned mirror system and therefore may be subject to a variety of distortions. Even among projection televisions, video purists prefer bulky front-screen projection because it eliminates the mirrors by placing a sizable box containing three picture-projection beams in front of the screen, at a precalculated distance.

Dimensia's video-cassette recorder (VCR) is a stereo-hi-fi device with two heads for audio, two for video, and a fifth for special effects. The VCR converts the audio to an FM signal and provides near-CD quality. It has a dynamic range of 80 decibels and a 20-to-20,000Hz, ruler-flat frequency response, with no measurable wow or flutter.

The integrated amplifier (an amp and pre-amp on the same chassis) offers 50 watts per channel (RMS rating, into 8 ohms, 20 to 20,000Hz, with less than .05 percent total harmonic distortion). A 100-watts-per-channel version is available with the same performance specifications. A less expensive option replaces the integrated amplifier and the tuner with a 50-watt-per-channel AM/FM receiver that has the same performance specifications, as well as 16 presets for the tuner.

Dimensia's three-way speaker system contains an 11-inch polypropylene woofer that is effective down to 35Hz. A four-inch polypropylene midrange covers 500 to 3,000Hz, and a one-inch dome tweeter runs up to 40,000Hz. There are speaker-level controls on the face panel for manual adjustment of treble and midrange response. These speakers are the typical high-quality, mass-market, Japanese speakers that audiophiles scoff at.

The electronic stereo FM/AM tuner has manual scan and automatic search for station sampling. You can preset up to 16 stations and access them through the remote control.

The CD player offers a 90dB dynamic range, with a flat frequency response from 5 to 20,000Hz. Wow and flutter are too low to be measurable. Like most high-end CD players, you can access any band, create your own band sequence, and automatically repeat.

The basic Dimensia turntable is a top-loading, linear-tracking, fully automatic model. Motor-speed accuracy is maintained to within .003 percent. A more expensive front-loading model offers a 16-band programmable memory, and all the functions can be operated by the remote control.

The audio-cassette deck comes with auto-reverse and Dolby B and C noise-reduction systems, metal-tape capability, and 15-band programmable random search. Dimensia can also accommodate a second audio-cassette deck for dubbing tapes, but, again, audio purists frown on the auto-reverse deck, since it can create problems with head alignment and is one more highly complex gimmick that can malfunction. The extra technology (and cost) do little to enhance sound quality.

If the $5000 to $6000 price tag for all this frightens you, you can always purchase a few components at a time. Since the video monitor-receiver is the central controlling device, you can start with that and the VCR, say, and add other components as your budget allows. But there is also considerable flexibility in price. "We're told to always advertise it at full 'retail,'" says Worldwide Electronics marketing director Phil Ressler, "which leaves us a lot of room to play with the price." The actual pricing strategy on Dimensia is complex, and there are new dealer programs every month that affect the bottom line. For instance, if you buy all the components (or sometimes even just most of them), you may get the turntable at no charge. Another program gives dealers a $250 bonus for selling a complete system, so the dealer can, theoretically, sell you a complete system at dealer cost and still make $250, or reduce the retail price by $250.

RCA has also created a lower-cost system that can use the basic control technology of Dimensia. The company introduced its Digital Command Components (DCC) this past August. This is an audio system that includes a 50-watt AM/FM receiver, audio tape deck, audio turntable, compact disc player, and a two-way or three-way speaker system. Here, the receiver is the master controller instead of the television, and it will operate both the audio and video elements when connected to many RCA monitor-receivers and VCRs. If you have an RCA ColorTrak 2000 with remote control, say, it will work with the DCC system.

RCA has limited the dealer network to 60 retailers in New England, says Lionel Brooks, merchandise manager at Eastco, the Westwood-based RCA distributor for this area. So though you won't find Dimensia in every audio/video store, there are enough outlets to allow you to shop around and negotiate an acceptable price structure. Even with the best of deals, Dimensia is not inexpensive. If you are willing to forgo the integrated remote-control capability, you can put together a system of individual components that offers better performance for the same money. The price of Dimensia includes delivery and installation, but you'd better make sure you have the room for it. The fully configured system is comparable in size to a large piece of furniture, and if you are getting the 40-inch video screen, you will need even more room for optimum viewing. Experts recommend that you watch TV from a distance of four to five times the length of the screen's diagonal to avoid fatigue, although that seems a little extreme. By that rule of thumb, the 40-inch screen would need over 13-feet of viewing room.

Originally, RCA aimed Dimensia at consumers in the $50,000 and up annual-income bracket, but it hasn't worked out that way, says Brooks. Those people buy top-end components and assemble state-of-the-art, high-performance systems. Dimensia customers are coming instead from the $25,000 annual-income bracket — "people whose family life centers around the TV," explains Brooks.

To be sure, Dimensia is an achievement in integrated circuitry, and many more consumer-electronics products are sure to follow its lead. But it is neither a state-of-the-art nor an inexpensive audio/video performance product. It will give good mass-consumer sound and video with the touch of a few buttons, accompanied by the flash of a few lights, but if you are the type of person who waxes religious about your audio experience, Dimensia is not for you. □

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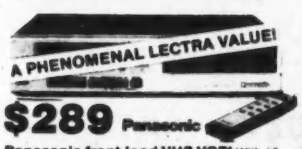

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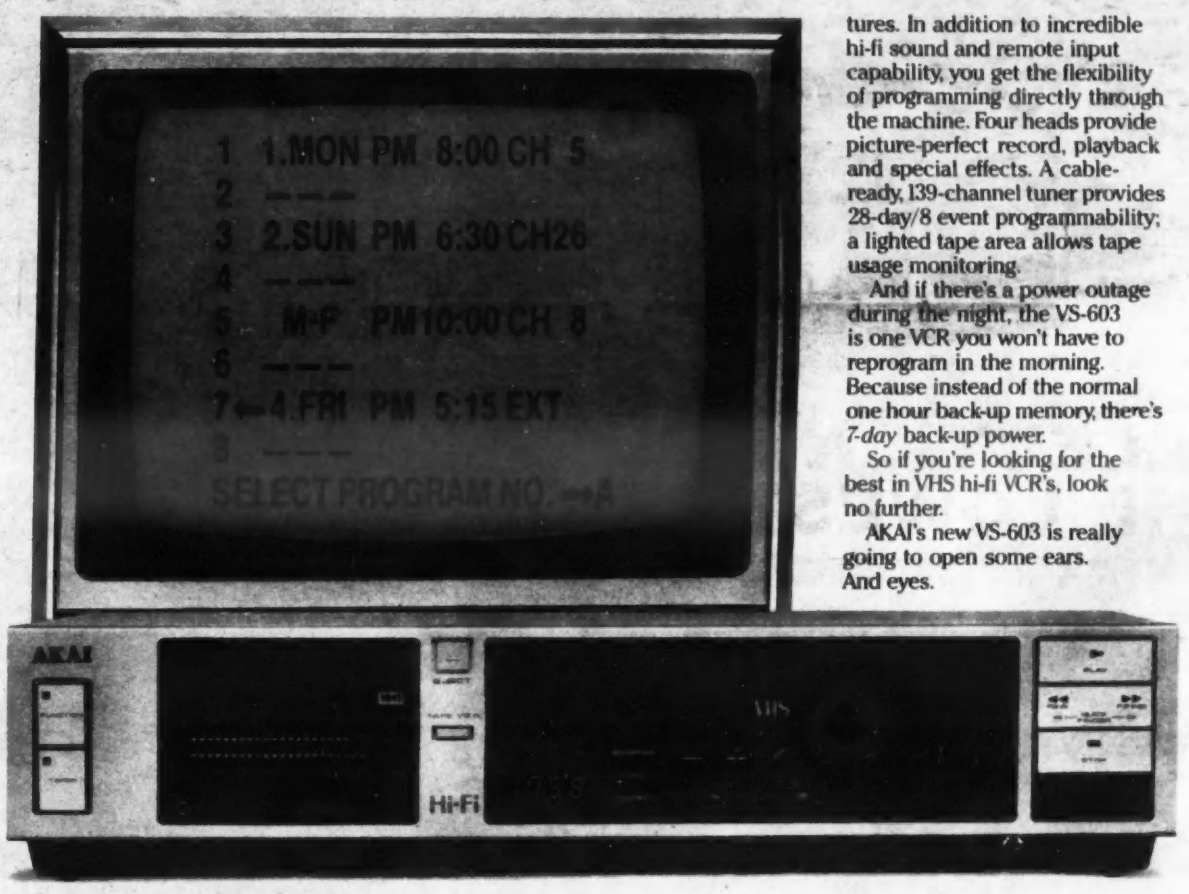

AKAI's new Hi-Fi VS-603 may well make ordinary VCR programming seem obsolete.

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What's more, the new AKAI VS-603 comes jam-packed with plenty of other impressive features. In addition to incredible hi-fi sound and remote input capability, you get the flexibility of programming directly through the machine. Four heads provide picture-perfect record, playback and special effects. A cable-ready, 139-channel tuner provides 28-day/8 event programmability; a lighted tape area allows tape usage monitoring.

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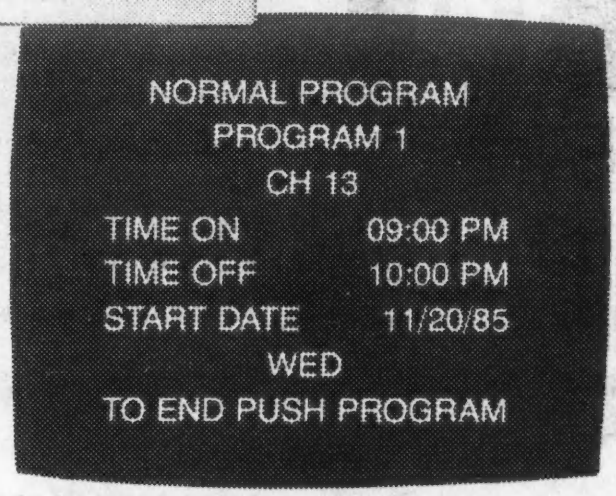

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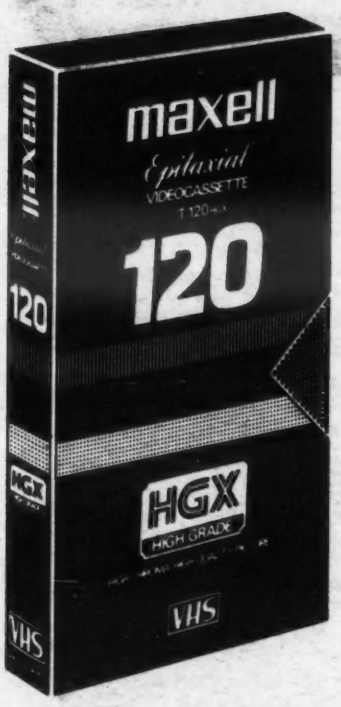

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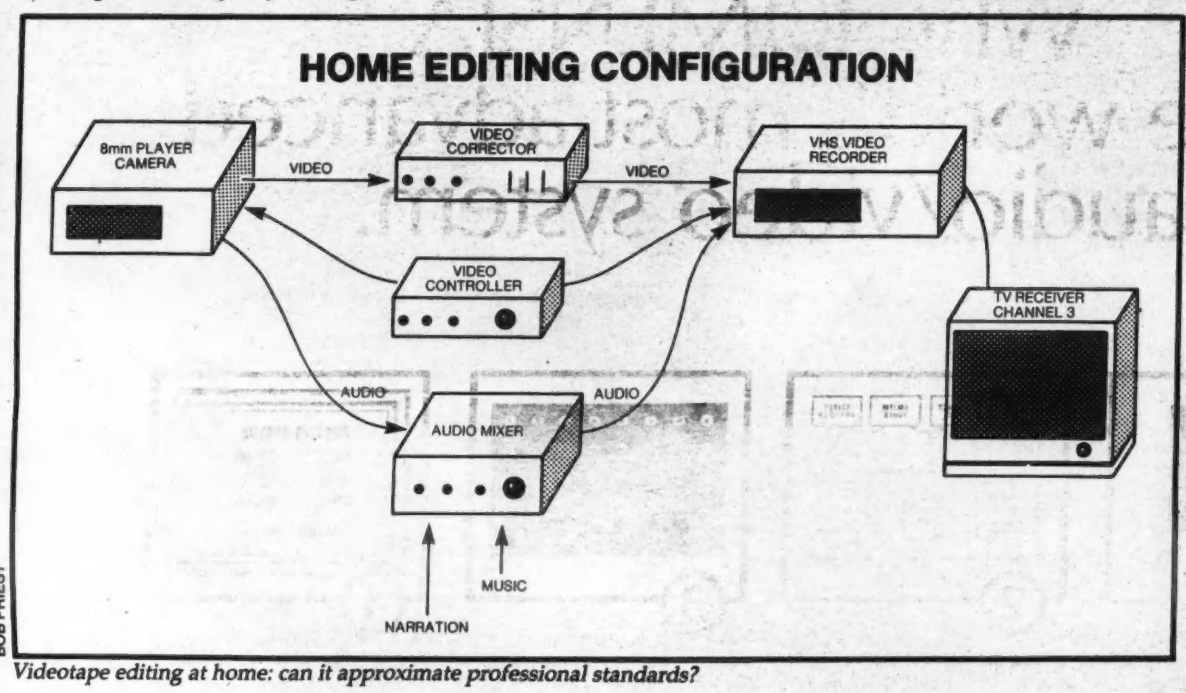
Taping liberties

Video editing at home

by Edward A. Imbier

Perhaps you returned from your summer vacation with five hours of videotape that you shot, or you captured the memories of a close friend's wedding with a rented video system. Maybe a favorite relative's anniversary is coming up, and you want to give her a photo montage on videotape, or you videotaped a meeting for your company, and you wish you had a short tape showing only the highlights. Let's say you adore Lionel Richie's music videos, and you want to put the MTV and Friday Night Video segments devoted just to him on one tape, or you want to consolidate the recordings of the best exercises from your aerobics class. And if you could shorten, reorganize, refine, and maybe even add titles or narration, your video recordings could be a whole lot better. You can do all these things by editing with your home VCR equipment.

If you'd like to try your hand at editing, you'll need two VCRs: one as a player for your original recordings, the other to dub onto. Unlike with film, no cutting or splicing with scissors and adhesive tape is required. Rather, you'll be editing a second-generation tape by making a series of electronic splices. With video editing, you can not only transform a series of video shots into ordered sequences, but also eliminate shooting mistakes, picture instabilities, and other undesirable footage.



Videotape editing at home: can it approximate professional standards?

In order to approximate the standards set by the professionally edited videotapes you're used to seeing on television, a home-edited tape should have good light exposure, color, tint, and sound; and no out-of-focus shots, jumps, unwanted dialogue, camera mistakes, pops, or unstable edits. But can the home-video novice — with less sophisticated equipment — get results that will measure up to what the pros can produce? Possibly, but not without first understanding what the process entails.

A number of technical issues must be resolved before the artistic aspects can be considered. First, how does the quality of the images stored by your VCR compare with those of a televised picture? Television picture sharpness, or resolution, is determined by the number of vertical lines that can be viewed on a television screen — 330 in the case of our current television system. But only those television receivers outfitted with a high-resolution picture tube and a comb filter achieve the optimum level of picture clarity. Most home televisions provide only about 260 lines, and home VCRs are limited to about 230 lines for 8-millimeter systems, 250 lines for VHS and Beta half-inch tape, and 300 lines for SuperBeta half-inch tape.

There's also the issue of the speed with which you record a video program. The best results are obtained with the fastest speed (standard play/2-hour mode on both VHS and Beta II), which delivers better sound quality and a more stable picture. The picture stability of the original copy can greatly affect the quality of multiple generation copies.

As for heads, one can get carried away trying to apply the old adage "two heads are better than one" to video: are four heads, then, better than two, and seven heads better still? To record a television frame, a basic VCR must have a minimum of two record/play heads on a spinning head drum, and, to play or record videotape, only two heads are used at any given time. (The camcorder uses four heads on a smaller head drum, however.) On a multiple-speed, four-headed video recorder, one pair of heads is used for the fastest recording speed, and another pair for the slower speeds. Some premium machines offer one extra head for special effects (pause and slow-motion functions) and still another pair for hi-fi audio. Since you'll want to do your recording at the fastest speed, a pair of wide video heads is desirable (58mm for SP-VHS; or 30mm for Beta II). The widest head VCRs give the highest-output recorded signal and, therefore, probably the most snow-free picture (that is, the highest signal to noise ratio). The Hitachi/RCA and JVC are among the machines with the widest track widths for VHS. Some two-head, two-hour, play-only VHS models that haven't been released yet will feature wide video heads, and they're likely to be the most cost-effective units for editing.

Now, does the kind of tape you use matter? Tapes seem to differ mostly in the output signal-to-noise ratio and in the number of dropouts (loss of oxide on the tape, which causes black and white spots in the TV picture). The difference between the best and worst tapes seems to be about 3db; the better tape will have a signal-to-noise ratio that s about 41 percent higher. This could be important in multiple generations, since losses of about 3db occur in each succeeding generation. The best home VCRs have signal-to-noise specs of about 45 db, and a signal-to-noise ratio of less than 40db will show up as white snow in a video picture. So, when copied, a mediocre tape and a slightly noisy recording could make for a snowy TV picture. Tapes with the lowest tape-path friction will produce the most table pictures on the screen in succeeding generations of copies. So you may have to test out a couple of brands of tapes to see which will perform to your satisfaction, or check out past issues of *Video* or *Consumer Reports* for their test results.

As to the sound quality on videotape, at the fastest recording speed, the sound will have good high-frequency reproduction, low noise interference, and low wow and flutter, even in the second generation. For superb sound quality, it is hard to top VHS Hi-Fi, Beta Hi-Fi, and 8mm digital sound; with their sound-recording techniques, both wow and flutter and noise are imperceptible in multiple generations.

The precision with which you can start and stop your VCR to make an electronic cut (an edit) is another important point. Home recorders have footage counters accurate to within a second or two, but the numbers may become inaccurate if you have to fast-forward or rewind your tape. If you edit by eye, using the PAUSE button on your VCR, you will be lucky to start and stop your recordings within a half second of your intended edit points. So, if your edited master tape requires greater editing precision, then you'll have to use a microprocessor-controlled editing system to position your VCRs accurately. The system uses either control-track pulses or a time code recorded on the videotape, which results in accuracy of your EDIT-IN and EDIT-OUT points to within one frame, or within one-thirtieth of a second. A half-inch editing system like this one costs about $5000 — well outside the limits of most household budgets. However, you can rent the use of such a machine in post-production facilities like Creative Video Design, in Needham, for about $25 per hour.

Another concern of home-video editors is the transitions from one shot to the next. Some VCRs can join two shots electronically with no seams showing — *i.e.* with no transitional instability. Other VCRs give you picture rolls, tears, and/or rainbow patterns at the transition points. For clean transitions, you need a VCR with backspace-edit capability on the recording side of the editing setup. This means that when you press the PAUSE control to stop recording, two things happen — the recording head shuts down and the tape slips back a few frames. Then when you hit PAUSE again to resume recording, the machine will first bring the tape up to speed while passing the last few frames of your last-recorded segment (thus giving the spinning video-head assembly time to lock onto the previously recorded track), and then automatically resume recording. This restart procedure takes about two seconds, and if it works, the video heads will synchronize themselves with the existing video-control track and start recording the top of the first frame of your next segment at the start of the video track, with proper spacing between segments. If you're using a VCR with a backspace-edit design, you can make good clean edits just by using your PAUSE control while the VCR is in the record mode.

Tape erasure is performed by an erase head that sweeps the entire tape clean ahead of the recording point. At the point where the last edit in a series ends, picture noise will occur for a second or so. To avoid this distraction, the last edit should be the last shot of your taped program. If an erasure under the video heads is incomplete and you start a new recording over old video material, rainbow patterns will result for a second or two. Only the 8mm and professional formats have erase heads flying along with the video heads on the video drum assembly; flying erase heads erase one frame at a time, so that the first frame will never have any interference patterns.

Many VCRs have three editing capabilities: assembly (record/pause), audio dub, and video insert (video dub). Most recorders with backspace-edit capability also have built-in assembly editing, that is, a function whereby the whole tape is erased clean and then video, audio, and control tracks are recorded simultaneously. Audio dub allows the recordist to replace an audio track with narration or music without erasing the video or the control track. Finally, the top-of-the-line machines allow the recordist to replace a previously recorded track using video-dub, without any jump and without affecting the control or sound tracks. This is great for adding stills, titles, and cutaway shots after assembly editing. The RCA/Hitachi portable convertable recorder has an especially fine insert function. Digital zoom effects and dissolves (fading out shot one while fading in shot two) are available in professional editing facilities, but at high rental rates.

After the taping has been completed, titles can be added in a number of ways. They can be typed and printed out from a computer. Some cameras have built-in character generators that can be superimposed on (keyed over) a video image coming through the camera. The most spectacular such unit is the Panasonic PK-959, which allows you to color black and white characters, or even key titles over earlier recorded video images. Titles can also be added using a stand-alone titler or Commodore Amiga that locks and keys over pre-recorded video; these units start at around $400. Otherwise, a computer that provides nice characters, such as the Macintosh, can key over pre-recorded video, if you can use a special effect generator with a key camera.

* * *

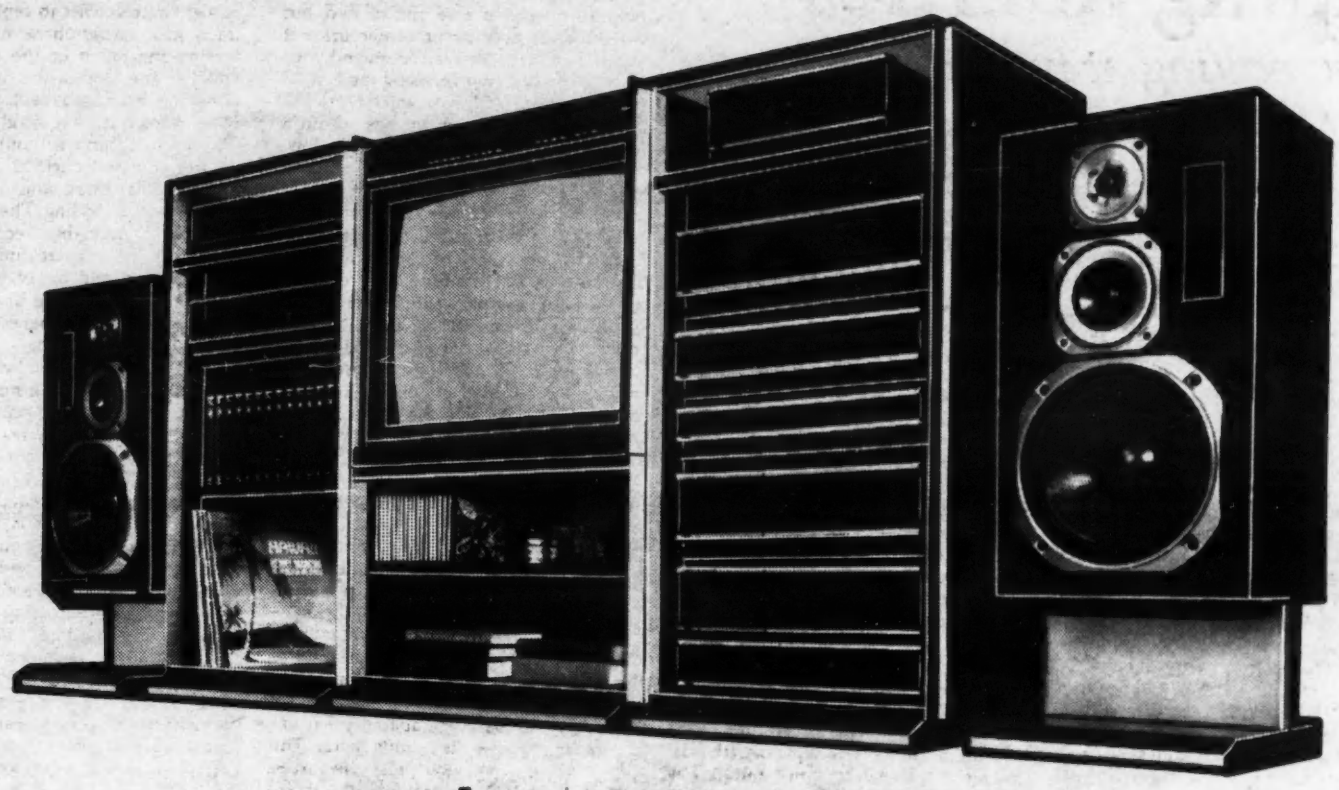
As for the most cost effective and convenient way to shoot and edit first-generation video, technology seems to be favoring the camcorder. For editing, the camcorder serves as the player, and a table model VCR is used as the recorder. Paul Roberts at Newtonville Camera is particularly excited about the Sony CCD-V8 Auto-Focus 8mm camcorder, which can be purchased with a controller that stores eight shots in a particular order and then edits the segments automatically onto various 8mm, VHS, and Beta VCRs. And Panasonic has a controller that goes between two of its portable VCRs.

Scads of gadgets and editing aids can be found in the back pages of many video magazines. In the audio area, sound mixers are quite useful for mixing live sound with narration and music. Fading accessories, which allow you to fade in elegantly from a black screen at the beginning of a sequence and fade out of the picture at the end, can be found for about $100. You can, however, always plan your fades by opening and closing the iris of a video camera. Picture enhancers can help occasionally, but they often result in snowy video images, or in picture edges that have taken on a cartoonlike look. George Voskanian, who does a lot of video editing around Watertown, prefers the JVC JX-C7 Video Corrector for its wide range of color correction that improves skin tones, as well as for its audio and video faders.

When a video system is connected to borrowed or rented equipment for editing, results can look quite professional if frame accuracy is not required and copies are limited to the second generation. If more generations are necessary, then SuperBeta, or a more professional format, such as a system using three-quarter- or one-inch tape, is required. If a professional editing recorder is used, a special dubbing-out function bypasses the internal frequency up-conversion and down-conversion circuits, thereby losing only 1db of signal-to-noise, instead of the customary 3db. Since a video frame is made up of two fields, professional systems have special circuits to put those fields in the right order for broadcast applications. Also, when multiple generations cause picture instabilities, the pro has the use of an electronic storage device, called a time-base corrector, that reprocesses and regenerates all video timing signals.

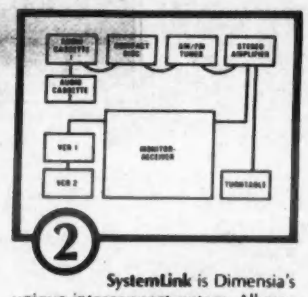
No matter how sophisticated your editing system is, there is no substitute for thorough preparation and organization. All of your footage should be viewed first and catalogued with footage counter numbers. From there, you can select the usable shots to make a final editing list to edit from. A good list saves time, wear and tear on the spinning head assembly and videotape, and money, if you're renting editing facilities.

Now that you know what's involved, it's time to tackle those summer-vacation tapes. Just remember that Steven Spielberg got his start editing short films at home; with video, it's even easier. □



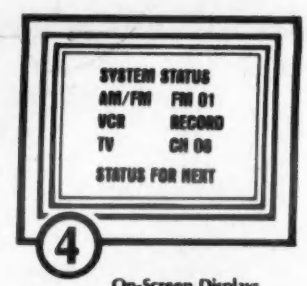
Why DIMENSIA is the world's most advanced audio/video system.

Dimensia Command Center provides direct push-button control of Dimensia components from your easy chair. Included with Monitor-Receiver which acts as system's central switching intelligence.



SystemLink is Dimensia's unique interconnect system. Allows you to connect most components in "daisy chain" fashion as shown above instead of running all connections to amplifier.

Rear Jack Panel on Monitor features input/output jacks which link all compatible devices. You can access several audio/video devices remotely, and Monitor's "intelligence" will do the rest.



On-Screen Displays make operation easy. These color-coded displays enable you to check the status of any system component and even prompt you when further instructions are needed.

Totally interactive. And one remote controls it all.

26" diagonal "Intelligent" Monitor-Receiver
Square-corner picture. Full Spectrum chassis processes 100% of audio/video signal. Three video and three RF inputs with cable loop-thru. Ready for stereo telecasts—no adapters needed.

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Record both sides without turning cassette over. 15-band programmable search. Dolby† "B" and "C" noise-reduction, metal capability.

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Select up to 8 bands, 15 different programs. Front loading.

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Includes quartz-synthesized tuning, fluorescent signal strength indicators, 16 station pre-sets for remote selection in any order.

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Also available:
40" diagonal Projection Monitor-Receiver. 50-watt AM/FM Stereo Receiver (RMS rating per channel, into 8 ohms, 20-20,000 Hz, with less than 0.05% T.H.D.), Top-Loading Linear Tracking Turntable.

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RCA
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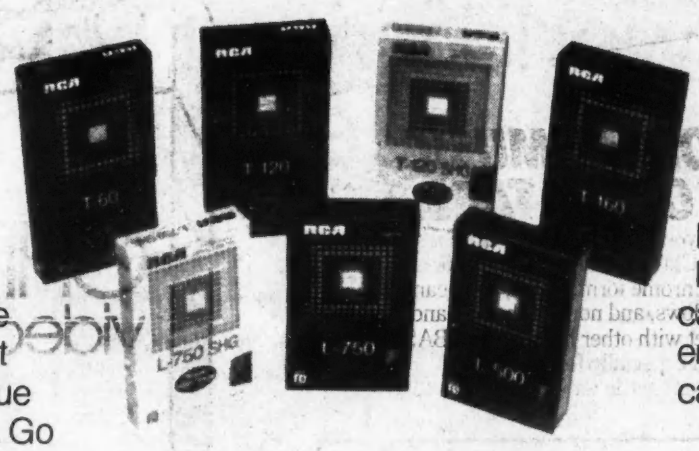
See Your Local RCA Dealer For Details

PERFORMANCE YOU CAN TRUST FROM THE NAME YOU KNOW IN VIDEO.

Today, there are hundreds of video products, tapes and accessories to choose from. All from different manufacturers with different quality standards.



But there's still one way to get the best combination of value and performance. Go with the name you know and trust. The name with one of the biggest video lineups in the industry: RCA.

We have proven our quality reputation year after year in every phase of video.

RCA accessories will enhance your enjoyment and your equipment's capability. Your RCA dealer has everything you need. From start-up kits, batteries, cables, cords and head cleaners, to cases for VCRs and cameras, lenses, wireless

Our blank video tape, for example, is designed to the same types of high-level performance standards as our VCRs. It's available in most popular lengths, in VHS and Beta, Premium

Quality and Super High Grade.

Our video accessories put on an equally impressive performance. Whether you're a first-year rookie or a video veteran,

mikes and tripods. And much more. All from RCA.

Why trust the performance of your video system to anything less than the name you know best? See your RCA dealer today.

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HEAR ALL OF THE MUSIC AND NONE OF THE TAPE.

Nothing comes between you and your music when it's recorded on BASF Pure Chrome audio tape. Thanks to BASF's exclusive Pure Chrome formulation, you hear all of the music's highs and lows, and none of the hiss and background noise you get with other brands. And BASF Pure Chrome is designed especially for the Type II Chrome Bias position. Don't settle for anything less than the world's quietest tape.

REPLAY AND RE-RECORD. THE QUALITY NEVER FADES.

No matter how many times you replay it or re-record on it, BASF Chrome Video tape keeps on delivering first-run sharpness, color brilliance, clarity and outstanding sound reproduction. The reason is BASF's exclusive Pure Chrome formulation. And BASF Chrome Video tapes are compatible with all VHS and Beta Video Recorders. Don't trust your recordings to any other brand of tape.

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New Products

Video-recording system

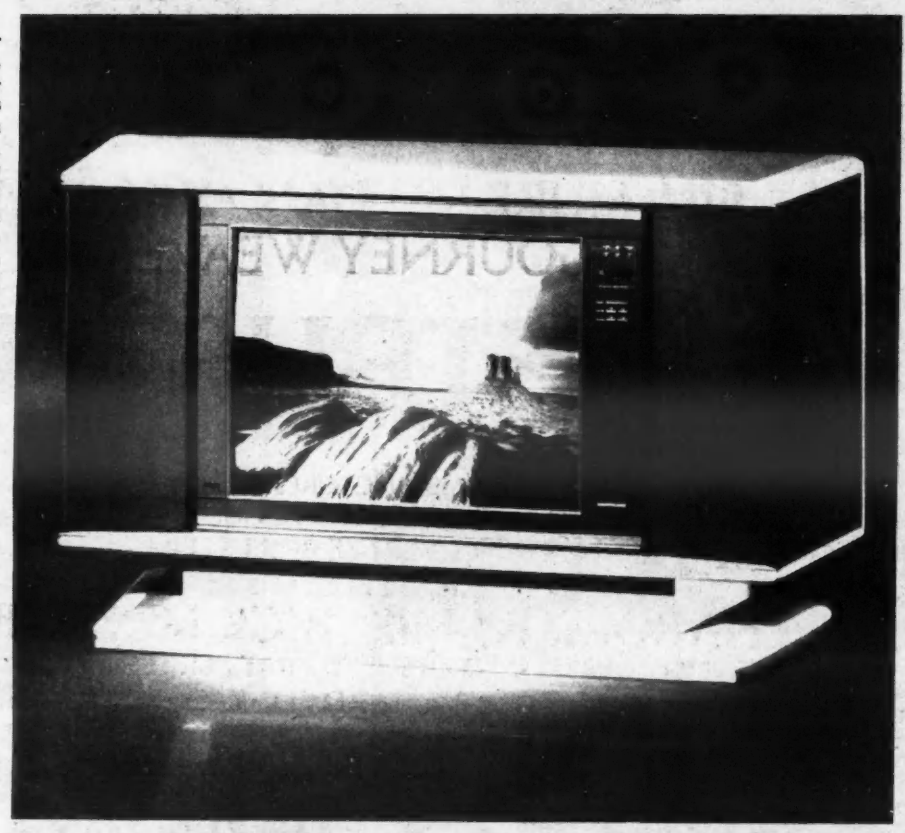
The ProWonder Camcorder CLR200 from RCA is a complete video-recording system: a color camera and a portable VHS video recorder all in one five-and-a-half-pound unit. Leave home movies in the Stone Age — now you can report live from Lebanon. This shoulder-held unit is no larger and is actually lighter than many movie cameras. ProWonder features infrared auto-focus, an f1.2 6:1 power-zoom lens, an automatic iris, and continuous auto-white-balance controls. A black-and-white viewfinder/monitor lets you "quick review" the last few seconds of previous recording. And there's an earphone for audio monitoring as you tape. A standby switch conserves battery power between shots. The standard battery (included) provides up to one hour of operation before it needs recharging, and an optional long-play battery allows for two hours of playing time. ProWonder comes with a carrying handle and shoulder strap for maximum portability. Optional equipment includes the CGA020 character generator — with 20-title storage capacity, time/date display, stopwatch, and other features — and a carrying case. The ProWonder is available for less than $1500.

Projection TV

The VS-526RS 50-inch front-projection television from Mitsubishi has everything you need to entertain a barful of your closest friends. Or set it up in the garage and pretend you're at a drive-in. The high-gain curved screen is washable, in case your guests like to throw their beer at the Big Game. The brightness equals that of most standard TV tubes, and the unit features 139-channel cable-compatible tuning, with channel memory, temporary time, and selected-channel displays. The TV lets you enjoy the stereo sound of four speakers with bass, treble, and balance controls. The unit's remote device controls include tuning, memory scan, color, tint, volume, mute, antenna, display, and a timer. The TV comes in an oak-veneer cabinet featuring doors to cover the screen and a shelf for your VCR. Suggested retail price is $3200.

Monitor-receiver console

The new ColorTrak 2000 console from RCA, model GLR2790, features a stereo monitor-receiver with two five-inch woofers and two two-inch tweeters in a "wedge" showpiece cabinet. RCA has designed a new square-planar picture tube that offers 25 square inches of extra viewing area, as compared with the 25-inch-diagonal tube. The picture appears flat, minimizing distortion at the edges and corners. These days knobs are out: the system comes with a Digital Command Center that looks like refugee equipment from a missile base. With a single hand unit you can control from the comfort of your favorite chair the TV, a compatible VCR, a variety of compatible audio components, and possibly the Soviet satellite network. ColorTrak's 10-connection monitor jack panel lets you plug in two audio/video input devices and an output to your stereo or TV. The unit's cabinet has a beige lacquer finish on fiberboard and select hardwood solids with brushed aluminum accents and concealed casters. When you're not watching TV, you can serve dinner on it. The console is priced at $1350.



Video monitor

From Proton's team of engineers comes the new 600M 19-inch TV monitor ($455). It features automatic color control, as well as optimum picture control, which automatically adjusts picture brightness for best viewing under varying levels of ambient light. A custom power supply filters out any interference that might distort depth or contrast, and Proton claims a wider dynamic range of video. The unit's standby mode will automatically turn the monitor off when it senses several minutes without video input signal, that is, when your VCR stops. Included is a built-in three and a half watts per channel stereo amplifier, but you'll need speakers to listen in — Proton offers its model 302 speakers ($130 per pair) for this system. If you want to watch TV, though, you'll need the 600T video tuner/audio preamplifier ($400). The unit accepts input from a VCR, antenna, cable, or laser disc, and it features separate bass, treble, and balance audio controls. Discrete circuits handle video and audio separately (and tactfully). The tuner's remote offers search, step, and direct-access functions.

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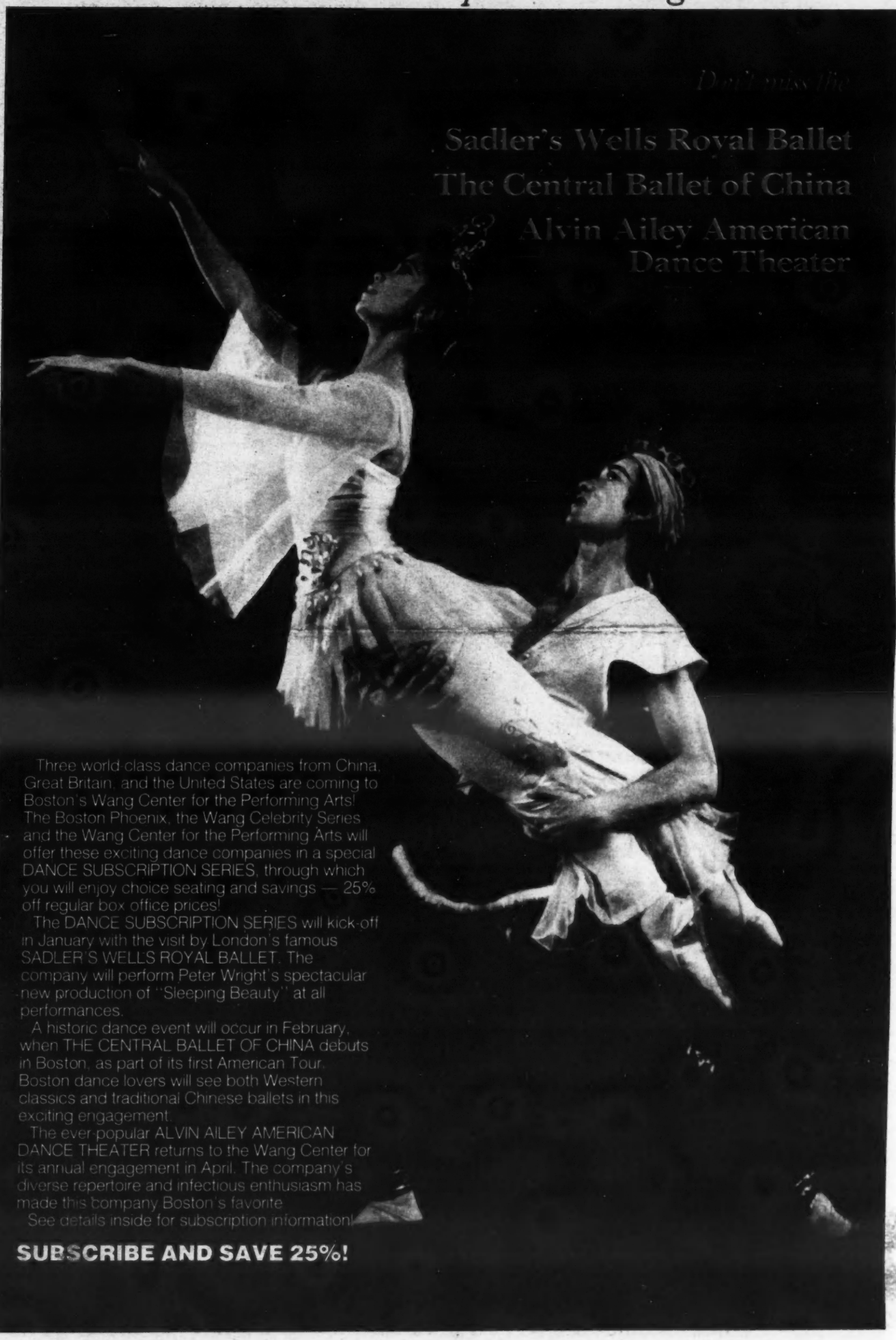
DANCE EXCITEMENT!

3 World-Class Dance Companies Coming to Boston!



Three world-class dance companies from China, Great Britain, and the United States are coming to Boston's Wang Center for the Performing Arts! The Boston Phoenix, the Wang Celebrity Series and the Wang Center for the Performing Arts will offer these exciting dance companies in a special DANCE SUBSCRIPTION SERIES, through which you will enjoy choice seating and savings — 25% off regular box office prices!

The DANCE SUBSCRIPTION SERIES will kick-off in January with the visit by London's famous SADLER'S WELLS ROYAL BALLET. The company will perform Peter Wright's spectacular new production of "Sleeping Beauty" at all performances.

A historic dance event will occur in February, when THE CENTRAL BALLET OF CHINA debuts in Boston, as part of its first American Tour. Boston dance lovers will see both Western classics and traditional Chinese ballets in this exciting engagement.

The ever-popular ALVIN AILEY AMERICAN DANCE THEATER returns to the Wang Center for its annual engagement in April. The company's diverse repertoire and infectious enthusiasm has made this company Boston's favorite.

See details inside for subscription information!

SUBSCRIBE AND SAVE 25%!

Sadler's Wells Royal Ballet

January 30–February 2

SADLER'S WELLS ROYAL BALLET, the touring section of one of the world's great ballet companies, comes to the Wang Center for a four-performance engagement, January 30 through February 2. Peter Wright's all-new production of Tchaikovsky's romantic classic "Sleeping Beauty" will be danced at all four performances. This golden showpiece, with its ornate sets and elegant costumes, has been described as a "magical production" (*London Sunday Times*) which "seizes the imagination as well as the eye ... will last to give years of pleasure" (*London Times*) and is "grand and spectacular" (*The Guardian*, London).

Artistic Director Peter Wright is hailed for his success in developing the quality of the company's work, creating an engaging identity for the company which has led to a tremendous following for the Sadler's Wells Royal Ballet. Discover them yourself; don't miss this Boston engagement!

"Peter Wright creates a world of grandest opulence and theatrical magic." — *Financial Times*, London

"... splendour, elegance, courtly dignities and fantasy charms ..." — *Stage and Television Today*, London

"Sadler's Wells Royal Ballet artists gave a magnificent account of themselves. A masterpiece has been honored." — *Financial Times*, London

Alvin Ailey American Dance Theater

April 8–13

Wildly popular with Boston audiences, the ALVIN AILEY AMERICAN DANCE THEATRE returns to Boston in April with its powerful conception of dance: a blend of modern, jazz and classical styles. This exuberant, multi-racial company has electrified audiences and stunned critics since its inception in 1958. Thoroughly American in its spirit and vitality, the company has performed for an estimated ten million people on six continents, "testimony to Mr. Ailey's belief that the beauty of art should touch all our lives and give us pleasure" (*New York Times*).

In its week-long engagement at the Wang Center, the Ailey company will perform such traditional classics as "Revelations," "Concerto in F," "Blues Suite" and "Memoria," as well as works new to Boston. The complete repertory will be announced in the near future.

"For sheer theatrical punch, no contemporary dance company can touch them" — *The Guardian*, London

"... the world has never seen a more powerful expression of sheer joy." — Clive Barnes, *New York Post*

"... the star of the Alvin Ailey American Dance Theater is the company itself ... they celebrate dance, they celebrate themselves, they celebrate life ..." — Max Wyman, *Vancouver Sun*

"... unmatched by any other dance company in the world ... — Anna Kisselgoff, *New York Times*

The Central Ballet of China

February 27-March 2

The Central Ballet of China in its first American tour will bring to Boston rich costumes, lavish sets and excellent acting in its opulent and stirring presentations of traditional ballets from the East and the West. The national ballet company of the People's Republic of China is highly acclaimed for its extensive repertoire of western ballets as well as for producing new ballets that reflect traditional and contemporary Chinese themes.

In its American debut, the company will perform two programs, both drawing from a repertory that features such traditional western classics as "Swan Lake" and "Giselle" as well as Chinese ballets which depict that country's uniquely fascinating heritage and folklore such as the "The New Year Sacrifice" and "Maid of the Sea."

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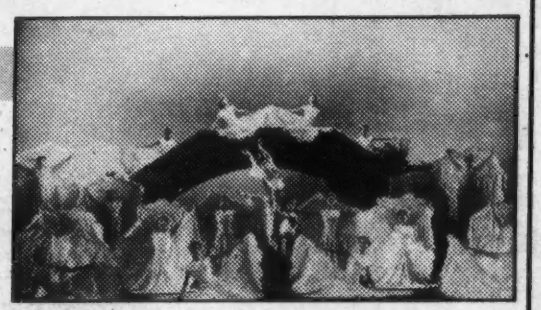

FEBRUARY 27 - MARCH 2

CENTRAL BALLET OF CHINA

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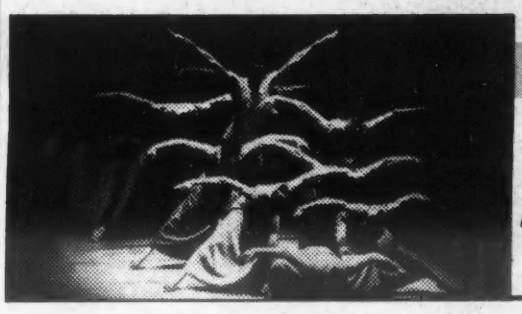

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SERIES B	FRI. EVE. JAN. 31	FRI. EVE. FEB. 28	FRI. EVE. APRIL 11
SERIES C	SAT. EVE. FEB. 1	SAT. EVE. MARCH 1	SAT. EVE. APRIL 12
SERIES D	SUN. MAT. FEB. 2	SUN. MAT. MARCH 2	SUN. MAT. APRIL 13
SERIES E	THURS. EVE. JAN. 30	THURS. EVE. FEB. 27	TUES. EVE. APRIL 8
SERIES F	FRI. EVE. JAN. 31	FRI. EVE. FEB. 28	WED. EVE. APRIL 9
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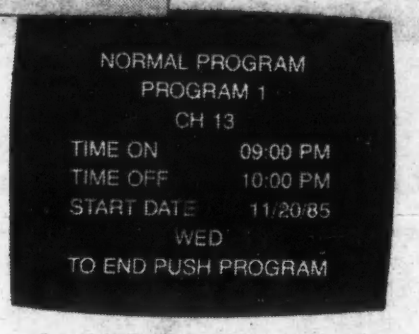

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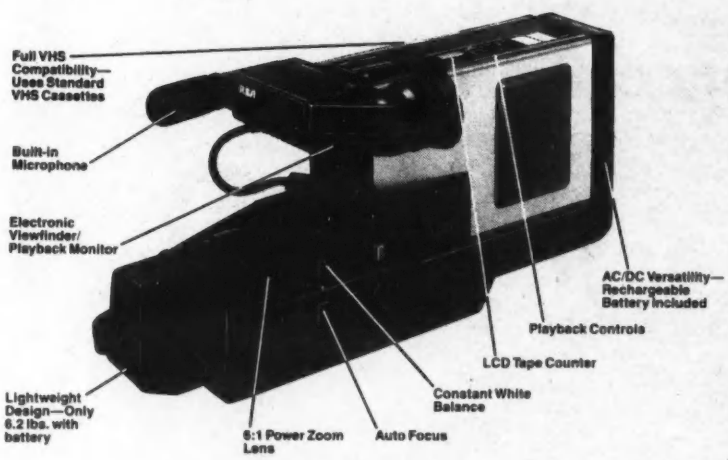
New RCA ProWonder Camcorder

Deluxe color camera and VHS video recorder...all in one compact unit.



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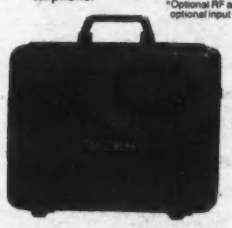
*Optional RF adapter required for standard TV playback, optional input cable required for external video recording.



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